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AN ANALYSIS OF RETURN ON INVESTMENT OPTIONS FOR THE USMC DISTANCE LEARNING PROGRAM

by

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March 2000

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A study was conducted to examine various aspects of Distance Learning (DL) applications currently under review by the Marine Corps, and determine whether these programs, if initiated, provide a positive Return on Investment (ROI). The objective was to determine how DL applications may be applied in the most advantageous manner, to increase the overall efficiency of current training programs from both a monetary and quality perspective. Specifically, DL applications were evaluated for pertinence to the four categories of learners found within the organizational hierarchy. To accomplish this objective, information was collected from the DL Branch, Training and Education Division, HQMC, as well as from faculty and staff at the Marine Corps Communications and Electronics Course, Marine Corps Air Ground Combat Center, 29 Palms, CA. Results were favorable with a positive ROI being determined from the stated assumptions. Other findings included that the most beneficial application of DL technology should be primarily toward advanced level training with possible considerations for Marines awaiting training, and that due to increased instructional requirements, the timesavings attributed to advances in training technology should not automatically result in reductions in formal course curricula. Simply stated, DL technologies provide great value added potential to enhance knowledge transfer in today's dynamic and fluid training environment, but should be viewed primarily as a complement to, rather than replacement for, traditional instructional methods.

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AN ANALYSIS OF RETURN ON INVESTMENT OPTIONS FOR THE USMC DISTANCE LEARNING PROGRAM

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A study was conducted to examine various aspects of Distance Learning (DL) applications currently under review by the Marine Corps, and determine whether these programs, if initiated, provide a positive Return on Investment (ROI). The objective was to determine how DL applications may be applied in the most advantageous manner, to increase the overall efficiency of current training programs from both a monetary and quality perspective. Specifically, DL applications were evaluated for pertinence to the four categories of learners found within the organizational hierarchy. To accomplish this objective, information was collected from the DL Branch, Training & Education Division, HQMC, as well as from faculty and staff at the Marine Corps Communications and Electronics Course, Marine Corps Air Ground Combat Center, 29 Palms, CA. Results were favorable with a positive ROI being determined from the stated assumptions. Other findings included that the most beneficial application of DL technology should be primarily toward advanced level training with possible considerations for Marines awaiting training, and that due to increased instructional requirements, the timesavings attributed to advances in training technology should not automatically result in reductions in formal course curricula. Simply stated, DL technologies provide great value added potential to enhance knowledge transfer in today's dynamic and fluid training environment, but should be viewed primarily as a complement to, rather than replacement for, traditional instructional methods.

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I. INTRODUCTION

A. OVERVIEW

1. Background

In the winter of 1944 the U.S. Army in Europe faced a critical manpower shortage, particularly in regard to combat infantrymen. These shortages stemmed from the tremendous losses in personnel taken during the proceeding months of campaigning in France and Belgium. In an effort to alleviate these shortages, the allied high command directed that the flow of replacements from bases in England and the United States be substantially increased. To meet this requirement, the quality and length of training new soldiers received prior to arrival at the front had to be reduced to get them there at a faster rate. Replacements were thus sent into combat inadequately trained and as a consequence suffered inordinately high casualty rates. Ambrose (1997) discusses how the casualty rates of typical replacements exceeded 50 percent, and normally occurred in less than 72 hours after their arrival simply because they lacked basic survival skills. Such information, he adds, was relatively easy to pass along and could be taught in a very short period of time, if only such time had been made available. Ambrose (1997) blames the entire American chain of command for this problem. He states that the plan was unquestioningly endorsed by the Army Chief of Staff, General Marshall, and the Supreme Allied Commander, General Eisenhower, to muffle complaints from field commanders, such as Generals Bradley and Patton, who consistently clamored for more fresh troops. All were found to share equal responsibility for casualty rates that are now viewed as excessive and wasteful (Ambrose, 1997).

In pursuit of this objective, it would later be found that many proposals for increased training efficiency actually caused more casualties than they helped prevent, as critical information was eliminated in the interest of increased throughput. Interestingly enough, similar problems would arise again in both Korea and Vietnam as the U.S. Army shortened training pipelines to get troops into combat at a faster rate (Ambrose, 1997).

2. The Problem

What relevance do such anecdotes have for today's military? In the current environment of highly complex, technically advanced combat information systems, it is imperative that personnel are as proficient as possible at their jobs. To gain and maintain such proficiency is becoming exceedingly difficult, however, as the quantity of pertinent information is growing at a rate far in excess of the time available to master it. The problem is thus how to maximize the potential of training and education methods while minimizing the time required for actual knowledge transfer.

3. A Proposed Solution

Current training technologies offer a solution to this problem by affording the student more opportunity to tailor learning to their individual lifestyles without sacrificing the quality of instruction. This paper looks at one aspect of these advanced training technologies in the form of distance learning. Distance learning technology has already been used with great success in civilian industry, academia, and by government agencies, to include the other services. The Marine Corps quickly recognized the advantages of such technology and recently invested quite heavily in the supporting infrastructure. This paper will attempt to measure the relative return that may be realized from such investment, particularly in regard to the more intangible aspects of quality instruction and its contribution to unit readiness.

4. Consequences of Inaction

Failure to properly address the problem of providing quality instruction in a decreased time horizon poses severe consequences for the military. Overall unit readiness will obviously suffer with spillover effects that include morale problems due to a lack of self-assurance, which may further lead to potential retention and recruitment difficulties. Most significantly, however, the military may be doomed to repeat the mistakes of the past, as inadequately trained personnel are sent in harm's way and pay the ultimate price for their ignorance.

B. PURPOSE

The purpose of this research is to examine various aspects of Distance Learning (DL) applications currently under review by the USMC and determine whether these programs, if initiated, provide a positive Return on Investment (ROI). The original goal was to evaluate DL as it relates to the following categories of learners found within the organizational hierarchy: (1) Initial skills training; (2) Advanced skills training; (3) Professional Military Education (PME); and (4) Marines awaiting training (MAT)/General Interest. It was quickly discovered, however, that to fully evaluate all the above categories in the limited time available was clearly beyond the scope of this research, so the focus was reduced to categories one, two, and four with an emphasis on categories one and two. Following this evaluation, the feasibility of implementing DL to improve the efficiency of current training programs is reviewed through empirical study and economic analyses.

C. THE NATURE OF THE PROBLEM

1. The Opportunity Cost of Training.

Where possible, the Marine Corps must employ the full range of world-class integrated instructional and information technologies that enhance the full spectrum of Marine Corps' training and education. Such training and education programs must encompass a cradle-to-grave methodology that begins with initial entry and specialized skills (*core and core plus*) training and continues through career-long professional development.

Reviews of current training and education processes reveal problem areas that significantly impact on operational readiness (Whitbeck, 1999). First, student load frequently exceeds formal school seat capacity resulting in large groups of Marines Awaiting Training (MAT). Second, initial skill resident training pipelines are increasingly long and have increased the training component of the Transients, Trainees, Patients and Prisoners (T2P2) manpower account and decreased overall manning in the operating forces. Additionally, career progression requirements for more senior personnel necessitate time away from operating units to attend appropriate grade level

schools, which also add to the T2P2 account. The current focus on resident formal school attendance as a prerequisite for Military Occupational Specialty (MOS) qualification is currently too rigid and frequently contributes to mismatch problems for the Marine Corps Reserve (Whitbeck, 1999). Further, the current Marine Corps Institute (MCI) paper-based distance learning courses are not closely linked to resident skill training curricula and do not contribute to MOS qualification (Taylor, 2000). Training design and development is often fragmented, lacking an integrated MOS curriculum. Finally, existing non-resident PME courses are based primarily on resident PME curricula, and similar to MCI lessons are not optimized for DL, making successful course completion difficult (Jones, 1999).

2. Why Distance Learning?

To assist the Marine Corps in meeting these challenges with increased flexibility, the Marine Corps Combat Development Command's Training and Education Division introduced the *Training and Modernization Initiative (TEMI)* in FY 1998. The objective of this initiative was to maximize the USMC's limited training design/development and training management processes, introducing improved technology into classrooms and capitalizing on modern DL technologies. PME programs will also benefit from this initiative as current distance education courses are enhanced through the application of advanced/emerging information technologies.

The TEMI attempts to correct many of the current training deficiencies outlined above through a comprehensive review and restructuring of current training and education processes. Restructuring will include improving instructional design, development, delivery and management processes. DL is a major component of the TEMI. DL technology has the potential to dramatically change the way in which Marines are trained and educated in the future. Just as developments in weaponry have changed the face of warfare, investment in DL technology has the potential to transform Marine Corps training and education from a centralized, formal school-based, synchronous environment to a more distributed, informal, asynchronous climate. The investment in technology will be driven by operational readiness requirements, and will be focused on improving the efficacy of the training and education programs provided to all Marines.

As promising as these initiatives sound, however, their implementation comes at a price. The objective of this research is to analyze the feasibility of implementing various

DL technologies within the current infrastructure and determine if a positive ROI can be obtained. The analysis addresses cost benefit techniques, cost factors in development and cost effectiveness measures.

3. Why ROI?

According to Derryberry (1998), during the past several years training organizations have been pushed by their clientele – both external and internal – to be more accountable for the quality of the resources and services provided. This focus on accountability has reached such a level that many training organizations within the government, and particularly in the military, are finding themselves competing against numerous types of budgetary decisions to maintain their current, if not higher, funding levels (Lyau & Pucel, 1995). At the same time, training organizations are being pushed to offer more efficient means of accessing performance improvement resources and services. The push for accountability means being able to demonstrate that training interventions have a direct positive impact on improving organizational competitiveness while increasing the productivity of individual contributors (Derryberry, 1998). This push for greater efficiency and accessibility has understandably led to expectations that interactive technologies will play an increasingly significant role in providing both services and resources.

Many organizations are beginning to require inclusion of a cost/benefit analysis (CBA) or ROI analysis to justify an expenditure such as what is required for a performance improvement environment or electronic learning system. Simply stated, ROI methods are used to demonstrate that the value of the benefits realized from using such a solution is going to exceed the price of its development and implementation. ROI and technology implementation clearly go hand in hand (Derryberry, 1998).

Even so, the author suggests that ROI is not simply evaluation methodology focused solely on financial concerns. Technology decisions are often not just about the financial bottom line. Even if data suggest that a low-end non-technological solution may yield positive results, there may be a variety of organizational reasons that a low-end technology solution my not be as attractive to a decision maker as is the more sophisticated, more costly technology solution. While ROI methods provide structure for systematically collecting, organizing, and compiling data, the interpretation of those data and the resulting perception of value those data represent may be highly subjective.

Although difficult to do, a sound ROI strategy on a prospective training technology program is certainly worth the effort if it provides the justification necessary to obtain funding support. In today's highly competitive budgetary environment, such a strategy may mean the difference between the ultimate success or failure of a program.

D. RESEARCH QUESTIONS

1. What are the current DL initiatives currently under review by the USMC?
2. What are the DL programs currently in use by the USMC?
3. What is the ROI objective for currently USMC training programs?
4. What are the costs and benefits of implementing various DL applications to current training programs in the USMC?
5. Do the benefits of DL initiatives as applied to these training programs outweigh the associated costs?
6. What are some common training development cost factors? Should they be included in this analysis?
7. Is Cost-Benefit Analysis (CBA) the most effective method for determining ROI on DL?
8. How cost-effective are current training programs? Has any positive ROI already been determined?
9. What other measures of cost-effectiveness can be used in determining ROI for training?
10. What aspects of quality should be taken into account when determining ROI for training?

E. EXPECTED BENEFITS OF THIS THESIS

This study will provide information to determine the feasibility, in terms of costs and benefits, of various Distance Learning initiatives currently under review by the U.S Marine Corps. It will serve as a decision tool by illustrating the potential ROI associated with each of these programs, based on the stated assumptions.

II. USMC DISTANCE LEARNING PROGRAMS

A. DISTANCE LEARNING DEFINED

For the purposes of this paper, the U.S. Marine Corps has defined Distance Learning (DL) as: "structured learning that takes place without the physical presence of the instructor." (HQMC T&E DL ROADMAP, 1999). This definition comprises traditional paper-based correspondence, but not stand-alone modeling and simulation. Key attributes of a sound DL program include (Portaway & Lane, 1992):

- Physical distance between learner and instructor
- Program sponsored by an academic institution or functional organization
- Program is part of a structured curriculum with stated objectives
- Program provides for two-way communication and feedback between institution and learner
- Program deployed outside the confines of a resident schoolhouse or campus
- Program includes processes to evaluate learning outcomes

The traditional classroom may be viewed as an island on which a teacher and a group of students, supplied with textbooks and other resources, manage the educational process. Occasionally, the students and teachers take trips into the outside world, but the overall educational process primarily focuses inward on things happening in the classroom. Contemporary telecommunications technology can invert this traditional focus. Classrooms now orient to the world outside rather than the immediate environment. Instead of remaining isolated islands, classrooms can now be linked by communication highways transmitting data (video and audio) to multitudes of remote sites. Teachers and students alike may now travel on this new information highway with easy access to vast databases and jointly participate in activities that involve other students in other countries (Lynton, 1992). This new technology can provide educational opportunities to students who lack access to a capable, resident classroom environment. Discriminating factors such as geographic dispersion, temporary separation, or unavailability of locally qualified instructors need no longer affect the individual's access to a quality education. Distance learning is an exceptional alternative when a training

facility cannot feasibly or economically provide quality face-to-face instruction to serve the remote student's needs.

Bramble (1990) states that distance learning is by no means a panacea for all the ills of the educational process, nor should it be viewed as a permanent replacement for face-to-face instruction. He found that students actually prefer face-to-face instruction. Unfortunately, distance learning is often viewed as a conceptual threat to the proponents of conventional educational methods. As such, distance learning advocates must be careful to present their approach as an alternative to conventional instruction, to be used when conventional methods are not feasible or economical. As this study will demonstrate, distance learning can be a cost effective alternative, although proponents should be cautious not to promote distance education solely on the basis of low cost. To properly support this emerging environment, which presently seems to offer great potential, organizations must first establish an infrastructure of policies and standards focused on long-term strategies for efficient implementation of distance education.

B. USMC DL TECHNOLOGY STRATEGY

Distance Learning can be accomplished through a variety of media including paper-based instruction, compressed video, Electronic Performance Support Systems (EPSS) and Virtual Reality (VR) simulations. As previously mentioned, DL and resident courses are viewed as complementary forms of instruction that enable the delivery of the right mix of instructional methods at the right time. In order to successfully transition to an effective DL program, however, the organization/institution must fully embrace an individual learning model vice merely shifting to a technique of remote teaching. Properly implemented, this transition will have wide reaching implications across any organization that adopts it, and will require a fundamental shift in traditional approaches to training and education.

The USMC's technology strategy is centered on the learner. The intent is to develop systems that enable current educational systems to reach more Marines with better and more focused training and education programs in the near future. In keeping with the Commandant's Planning Guidance (Krulak 1995), the aim of Marine Corps' training and education is to extend learning beyond the boundaries of the traditional classroom by exploiting technology. Technology has matured to the point whereby it is now possible to deliver high quality interactive instructional materials using multiple

media formats without regard to time, space or distance. Moreover, the rapid growth of the Internet has changed the perception of information sharing, electronic commerce, methods of instructional delivery and collaborative learning. Academia, government and industry are using this medium to train and educate the modern work force. The Marine Corps will also use Internet-based technologies to deliver interactive learning products and facilitate a collaborative learning environment in the future.

Distance Learning programs are learner-centered rather than instructor-centered. They are being designed specifically with the distance learner in mind as per the HQMC Training & Education DL Roadmap. In HQMC's plan DL solutions will be network-delivered where possible; exploiting the power of the Internet in order to distribute and track computer-based interactive multimedia instruction (IMI). Realizing that a robust infrastructure is required to support a network-based learning environment, interim hybrid solutions are already in the works. The roadmap further outlines solutions that include a combination of the Internet, CD-ROM technology and traditional paper-based DL courses, until the proposed enterprise network can adequately support network delivery. The plan also describes how this network-based learning will be additionally supported with video teleconferencing and teletraining capabilities to leverage existing service and government video networks.

Finally, for the long term the HQMC DL Roadmap identifies the development of artificial intelligence, intelligence agents, intelligent tutoring systems, performance support and embedded training technologies that will be encouraged during new system acquisitions to reduce the requirement for equipment specific training.

C. USMC DISTANCE LEARNING STRATEGIC VISION

Existing and emerging information technologies provide an excellent opportunity to deliver flexible and adaptable training and education solutions. The goal of USMC training and education programs is to encompass a "cradle to grave" approach that begins with initial entry and specialized skills training and continues through career-long professional development (HQMC T&E DL ROADMAP 1999).

The Marine Corps developed the *Training and Education Modernization Initiative (TEMI)* as a substantial part of its overall educational strategy to meet new challenges with increased flexibility. The objective of this initiative is to maximize the Corps' limited training and education resources by restructuring current institutional

training, improving existing training design/development and training management processes, while simultaneously introducing technology improvements into classrooms that capitalize on modern DL technologies. Professional Military Education (PME) programs will also benefit from this initiative as current distance education courses are enhanced through the application of advanced/emerging information technologies.

D. OPPORTUNITIES AND CHALLENGES

The question naturally arises as to why DL and training technologies should be embraced? An increased emphasis on the use of DL technologies will greatly enhance training and education opportunities for all Marines for a number of reasons. First, there is a momentum across industry, academia and the other services to exploit modern technology for the purpose of improving instruction and increasing opportunities for access. Recent advances in technology have made DL an increasingly viable option to deliver courses of instruction on demand, with minimal regard to time and distance. Secondly, the Executive Branch has specifically tasked the services as well as all other Federal agencies to increase the use of DL where possible to reduce the cost of institutional training and education programs (EO 13111, 1999). Finally, DL has the potential to "level the playing field" for reserve forces by providing them with increased opportunities for training and education. Expanded use of DL will help reduce resident training time and training and education costs, while increasing educational opportunities for all Marines (Tyler, 1998).

The military and civilian industry can no longer afford to conduct training and education in the same outmoded, predictable fashion. The challenge today is to meet increased training and education demands in spite of reductions in funding, manpower and training infrastructure. While resources are decreasing, requirements for training and education are constantly increasing. Changes in demographics, procurement practices and organizational structure have resulted in a younger force, new equipment, changing missions and MOS mergers; all of which impact training and education requirements. Studies in both civilian academic and military training environments assert that DL offers a means to meet these emerging and fluctuating demands (Moore & Kearsky, 1996; Freeman, 1999).

Distance Learning applications can reduce the cost of traditional training and education while still meeting traditional training and education needs (OUSDP&R,

1999). A study conducted by the Logistics Management Institute (Belcher, 1999) states that use of network and CD-ROM distribution in DL can significantly reduce the production and distribution costs associated with conventional paper-based courses. Phelps, Wells, Ashworth and Hahn, (1992) convincingly demonstrate how offering a course via DL can also reduce or eliminate travel and per diem costs. An analysis of two identical study groups, one in residence and the other using Computer-mediated Communications (CMC) technology from the U.S. Army's Engineer Officer Advanced Course, resulted in cost savings in excess of $600K based on five iterations of the course. Course topics included technical engineering skills as well as Army tactics, leadership and briefing and presentation skills. The Battle Staff Noncommissioned Officers' Course (BSNCOC) at Fort Bliss, Texas, estimates an average cost savings of more than $30K per student for its six-week course (Belcher, 1999). Adopting DL practices can also provide widespread access to training and education resources. For example, it can increase student throughput as illustrated by the Air Force Institute of Technology (AFIT), which increased student throughput from 300 to 3000 for its Acquisition Planning and Analysis course by converting it to a DL format (IDEA, 1999). The Naval Postgraduate School is pursuing a similar course of action for several of its graduate education programs (Hazard, 1999). Finally, the Army National Guard is developing comprehensive DL programs to increase training opportunities for over 36,000 Guardsman across the United States (Metzko, 1996).

Advanced technologies are currently being explored to develop and deliver learning products *just in time*, when and where they are most needed. In the future, Marines can expect to use a Navy/Marine Corps Intranet (N/MCI), the Internet, learning resource centers (LRCs), interactive multimedia instruction (IMI), video teletraining (VTT) and embedded training (ET) to master new skills. Although Distance Learning technologies have the potential to yield savings, they can be costly to initiate, requiring a substantial up-front investment (Tyler, 1999). The cost of implementing technology that fails to live up to expectations, highlights the importance of a coordinated approach to research, development, acquisition and life cycle management. Acquisition projects, such as the USMC's DL Program are therefore consulting training design specialists early in the requirements definition phase to reduce the cost of training and align it with the existing Marine Corps training standards (MCSC DL LCCE, 1998). The continued partnership between the acquisition force, manpower specialists and training has the

potential to achieve significant life cycle cost efficiencies for major Marine Corps equipment procurements in the future.

Many of these technologies are still under development and require further study to ensure that each will be a cost-effective solution to growing training and education requirements. Likewise, the partnership between acquisition, manpower and training remains in its infancy and must be cultivated to fruition. Moreover, development and maintenance of long-term partnerships with other services remain crucial to benefit from their technological advances, while meeting Marine Corps specific requirements and defraying overall costs.

E. MODERNIZATION TENANTS

Training and education is an investment in operational readiness. Restructuring existing programs must focus on enhancing operational readiness by making training and education better and more efficient. The basic tenets of the modernization initiative are as follows (HQMC T&E DL ROADMAP, 1999):

- Training and education are a core responsibility of the Service
- Operational readiness is the primary consideration for implementing training and education programs
- Marine Corps training and education will be standards-based
- A Marines' educational experience is part of a career-long learning continuum supporting the operational needs of the total force
- Technology will be leveraged to improve the effectiveness and efficiency of Marine Corps training and education
- DL will increasingly be used to meet future Marine Corps training and education requirements
- The Marine Corps will leverage other DoD and governmental agency DL and instructional technology efforts

F. THE MARINE CORPS DISTANCE LEARNING PROGRAM

1. Overview

The revised Marine Corps DL program expands on the paper-based system of the Marine Corps Institute (MCI) by developing integrated training and education programs for initial skill and skill progression training that lead to Military Occupational Specialty

(MOS) qualification, and also enhance current distance education PME programs. The DL program is a funded Total Force program supporting both the active Marine Corps and the Marine Corps Reserve. Implementing comprehensive DL programs is a complex undertaking and involves developing innovative solutions in four major technology domains: instructional content, delivery infrastructure, instructional management systems for delivering courses and managing students in a distributed environment and instructor training and support (HQMC T&E DL ROADMAP, 1999). The DL program will offer solutions in each technology domain and will be implemented according to a two-phase schedule – a pilot phase (FY97-99) and a program expansion phase (FY00-05). The pilot effort was initiated to study infrastructure and process and resource requirements, to successfully establish a viable DL program. Lessons learned from the pilot effort are being used to shape the DL program so that limited resources can be effectively focused on establishing a flexible Corps-wide DL capability in the future. A major part of implementing the USMC DL program will center on the establishment and activation of the Marine Corps Learning Network or *MarineNet* infrastructure. As of this writing, it is envisioned that *MarineNet* will function as a subcomponent of the larger N/MCI that is currently being planned (CNO, 2000; Whitbeck, 2000). For the purposes of this paper, the use of the terms N/MCI and *MarineNet* will be synonymous. *MarineNet* is a wide-ranging initiative that provides the supporting infrastructure and access points to enable the delivery of high quality training and education to all Marines, regardless of location. *MarineNet* is essentially a Marine Corps-wide distributed Intranet supported by compressed video technologies that will enable Marines and civilian DoD personnel to learn via the appropriate media when and where learning is most needed and required (HQMC T&E DL ROADMAP, 1999). *MarineNet* is composed of electronic interactive DL courseware, hardware, software and network components necessary to distribute electronic instruction over Marine Corps wide area, metropolitan area and local area networks.

The N/MCI will use the planned Defense Information Infrastructure (DII) architecture for wide area connectivity across the Marine Corps enterprise, and the planned Base Telecommunications Infrastructure (BTI) upgrades for metropolitan area and local area network connectivity aboard bases and stations (HQMC T&E ROADMAP, 1999). The R-net will provide network connectivity to the 194 reserve sites across the country (Metzko, 1996). Open system architecture will be used to ensure interoperability between Marine Corps and other service DL and communications systems and platforms.

2. Organizational Roles to Support USMC DL

The DL program and *MarineNet* will be supported by the following organizational components: the Distance Learning Center (DLC), Functional Learning Centers (FLCs) and Area Learning Centers (ALCs). These components conform to a three-tier approach for DL. Each center corresponds to an echelon within the Marine Corps and has specific roles and responsibilities to that organizational level. As mentioned previously, the components of the functional structure are physically interconnected via the BTI. The BTI will provide an upgraded network infrastructure aboard all bases and stations as well as telecommunications "pipes" between Marine locations via the Defense Information Systems Network (DISN) (HQMC T&E DL ROADMAP, 1999).

The MCI designated as the DLC, is the Corps-level organization that will provide Marine Corps-wide standardization, certification and quality control for all DL in the future. The DLC will provide a consolidated Corps-wide on-line catalog of DL products to include a VTT broadcast listing, accessible through the Internet. The DLC will also manage master DL manpower data, ensuring complete and accurate information on enrollments, completions and qualifications are passed on to the Marine Corps Total Force System (MCTFS).

The formal schools currently in existence will serve as FLCs and functional area proponents, managing all electronic DL courses related to their specific area of expertise. Multimedia course development and maintenance will occur at Regional Development Centers (RDCs). RDCs are supporting organizations that will also manage contractor-developed DL products, ensuring that they conform to established Marine Corps' standards and protocols. RDCs will be under the operational control of the DLC and under the administrative control of the local base establishment. Electronic course distribution will occur from FLC servers, while paper-based distribution functions will be retained by the MCI.

The RDCs will provide centrally managed and dedicated course development teams at selected Marine Corps Schools (i.e., FLCs). The two FLCs initially selected to host RDCs are the Marine Corps Communications and Electronics School, located at 29 Palms, California, and the Marine Combat Service Support Schools, Camp Lejeune,

North Carolina. The RDCs will support the FLCs in their respective geographic locations (i.e., East Coast/West Coast). Each RDC will be responsible for developing technology-based courseware and managing contractor developed content for its client FLCs. The FLCs will provide actual course content and subject matter expertise. The course development section of the MCI will provide content development support to smaller formal schools/detachments, as well as assist with overflow course development from the two RDCs. Establishing an RDC for PME course development at the Marine Corps University is scheduled to begin in FY 00.

The ALC is the primary metropolitan area network for delivering DL courseware to Marines in a given geographic area. The ALC will be comprised of a Training and Education Point of Presence (TEPOP) server with one or more interconnected Learning Resource Centers (LRCs) and VTT Centers. The number of LRCs and VTT Centers within the ALC geographic region will depend upon the size of the region and the population size supported by the base, station or site. The ALC will provide local DL account management, storage and distribution of electronic courseware to any authorized user connected to the ALC network.

The primary access to *MarineNet* will occur at the local level ALCs. The ALC TEPOP server suite is designed to provide local (regional) instructional material storage, distribution and security services. One TEPOP is required per ALC (region) and will service many "tenant" FLCs and LRCs. The storage resource will provide the capacity for all electronic training material to be accessed through workstations aboard the base, as well as the necessary management tools to monitor student progress, monitor network utilization, determine courseware availability and suitability and maintain statistical information.

The LRC is designated as the primary location to access DL courseware for those Marines who do not have access to computer workstations. The LRC is a client-server Local Area Network (LAN) system connected to the base network backbone and accesses courseware stored on the regional TEPOP server suite. Each LRC can accommodate approximately 25 to 40 simultaneous users. Approximately 94 LRCs will be procured as part of the DL program in addition to the workstations already connected to the Marine Corps enterprise network (HQMC T&E DL ROADMAP, 1999).

Where established, VTT Centers will provide the capability to conduct DL using the latest Video Teleconferencing (VTC) technologies. The centers will have a two-way video and two-way audio (2V/2A) capability and the ability to accommodate 15 to 20

simultaneous users. The system will conform to all DoD standards and guidelines and will be capable of multi-point conferencing with all VTT centers DoD-wide (Cabrera, 1999). The *MarineNet* VTT systems will leverage the existing Marine Corps Satellite Education Network (MCSEN), and the Navy's CNET Electronic Schoolhouse Network (CESN) capabilities. The DL program will field 25 additional VTT sites that will be interconnected with the MCSEN and CESN systems at both active and reserve locations.

Plans also call for deployable LRCs that will provide operational units with the capability to access DL resources while deployed abroad (HQMC T&E DL ROADMAP, 1999). These small self-contained, ruggedized client-server networks will emulate the capability of the fixed site LRC. Further, they will have the capability to connect to shipboard or external Transmission Control Protocol/Internet Protocol (TCP/IP) networks. The system is composed of a server and ten client workstations. Courseware will be uploaded onto the deployable server prior to deployment and updated through a "reach back" capability to the host unit TEPOP where adequate long haul communications links exist.

The Marine Corps DL program relies upon the implementation of the BTI upgrade. Delays in BTI network implementation will thus defer the fielding of MarineNet (Tyler, 1998). Program sponsors are currently working closely with the Marine Corps Systems Command and the bases/stations to coordinate BTI implementation with *MarineNet* fielding (Tyler, 1998). Successful integration with the R-Net is also critical to the success of the DL program for the Reserve component (Tyler, 1998). R-net integration issues will be thoroughly studied during the pilot phase of the DL initiative to ensure adequate interoperability before program expansion in FY 00.

3. DL Content Development and Management Issues

An integral part of the Marine Corps TEMI also involves a comprehensive review of all formal training tacks. The Training and Education Division will lead the effort to conduct detailed training reviews for 100 percent of all institutional training courses over the next six years (HQMC DL ROADMAP, 1999). Training reviews will commence with those occupational fields determined to have the greatest potential savings in terms of MAT and transient times. Further, those courses with insufficient capacity to meet throughput requirements will be the first candidates for review. The objectives of the training review process are:

(1) Design a comprehensive MOS training concept.
(2) Identify essential job performance competencies and supporting tasks for MOS qualification.
(3) Design a training progression model that meets career track requirements for each MOS.
(4) Redesign courses as appropriate to incorporate both resident and DL to achieve MOS qualification within established resource guidelines.

Once the curriculum reviews are completed, FLCs will design and develop both resident instruction and DL products to support the new training progression models and curricula. Course development efforts at the formal schools will be supported by the RDC and MCI development teams, or through commercial outsourcing. The implementation of revised integrated curricula will vary depending upon the complexity and subject matter involved; however, the time window for this process is to begin delivery of new training and education solutions within six to nine months of commencing the review process.

Another component of the DL program is an enterprise-wide management system to coordinate courses and students in a distributed environment. The system must be flexible to adequately support a highly mobile population of active duty and reserve Marines, to include civil servants for on-line registration, tracking and assessment. Further, the system must be able to accommodate not only training events, but PME and voluntary education opportunities as well. The system of the future will provide an alternative registration and assessment capability for traditional DL courses until they are eventually phased out, and serve as a secure gateway for new on-line DL courseware and materials. The system is planned to be accessible through both *MarineNet* and the conventional Internet.

From a human resource perspective, a further consideration is that DL is a relatively new operating environment for Marine Corps instructors and curriculum developers. Exposing these instructors, training developers and senior leaders to emerging DL instructional technologies will greatly assist them in overcoming the normal apprehension associated with applying new methods and training concepts. Accordingly, instructor development and support are critical factors to the overall success of the DL program. To help facilitate this transition, the DLC and the Instructional Management Schools located on both coasts will develop instructor-training programs and provide technical support to ease the expansion of DL capabilities across all Marine Corps formal

schools. Training programs will include information on the instructional design process, implementation of DL instructional technologies and project management. Additionally, the DLC will provide a help desk to support DL instructors and curriculum developers at the RDCs and FLCs.

This review process is a significant effort. It will require time and dedicated effort on the part of all relevant parties to develop pertinent and cost effective training solutions for each of the MOSs considered. This situation does however, present the Marine Corps with an opportunity to enhance training and education through a restructuring effort that will yield even greater dividends in the future.

G. CHAPTER SUMMARY

The objective of the TEMI and more specifically the implementation of DL, is to provide better and more effective training in an environment of increasingly fewer resources. Initiating modern instructional technologies to both deliver DL and simultaneously enhance our resident school training, presents significant but not insurmountable challenges. Meeting the established goals of reducing MAT, overall training time and training structure, while providing better and more efficiently delivered instruction to Marines is only a part of the challenge. Shifting to a learner-centric vice instructor-centric approach to learning, while ensuring computer literacy, making limited time available for Marines to train via DL techniques, and also overcoming institutional bias and resistance to change, present challenges of equal if not greater magnitude.

Distance Learning, although not a panacea for all training and education issues, is an established and proven method for delivering training and education without sacrificing quality. MCI has been providing paper-based DL to Marines for more than 75 years with great success. Modern technology provides an opportunity to significantly improve the quality of the learning experience. Further, such technology will enable the Marine Corps to successfully achieve its goal of providing more Marines a higher quality of training and education while reducing the required resources.

III. ELEMENTS OF ROI FOR DISTANCE LEARNING

A. INTRODUCTION

Literature about the cost effectiveness of distance education tends to focus on costs of specific media implementations (Rumble 1989; Solomin and Holden 1988); pragmatic discussions of models and costing issues (Markowitz 1987; Rumble 1988); and comparisons between traditional resident instruction and distance education (Hahn, Ashworth, Phelps, Wells, Richards & Daveline 1991; Laidlaw and Layard 1974; Muta 1985; Rule, DeWulf & Stowitschek 1988; Wagner 1977). The literature suggests that distance education can be less expensive than resident instruction, depending upon student enrollment and the fixed costs of course development and delivery. Furthermore, the literature compares the training effectiveness of distance education to face-to-face resident instruction, and suggests that distance courses delivered with various media compare favorably with resident instruction. The conclusion that such effectiveness is equal among these two methods is not generally accepted, however, due to disagreement over such issues as the value of human interaction in training and education (Beare 1989; Jevons 1982; Misanchuk 1982; Whittington 1987).

The major challenge of distance education is increasing access while controlling the cost of delivery. Meeting this challenge while maintaining effective instruction is crucial to achieving the return on investment necessary to insure the viability of distance learning programs. The imperative of access and cost effectiveness requires the selection of the least expensive alternative that meets the course objectives and reaches the intended audience. All things being equal, the more access and less expensive the method, the better for all concerned. Courseware designers and managers are expected to be good stewards of resources entrusted to them seeking efficiency in their designs. Executive Order 13111 recognized an obligation to increase access while controlling costs.

It would appear that for all the emphasis placed on minimizing training expenses, a thorough cost analysis of training alternatives is not an easy thing to do, particularly where DL technology is concerned. Variables can be many and ill defined. The remainder of this chapter provides insight to those elements critical in obtaining a favorable ROI for DL. Issues include a discussion of cost benefit analysis (CBA) versus

cost effectiveness analysis (CEA), a review of cost-benefit techniques, factors of cost analysis in training and development, and a look at measures of effectiveness commonly used in determining ROI for DL.

B. ISSUES AFFECTING ROI FOR DL

1. Overview

If one can deliver instruction to many students at their home stations economically, there surely must be cost savings over bringing those same students to centralized training. Russell (1999) argued that DL can reduce training travel and per diem costs compared to schoolhouse-based instruction, and that the training results in no significant difference in training effectiveness. This reasoning, although supported by over 300 studies, is still considered highly subjective and is far from conclusive. Discussion comparing the effectiveness of these training methods is a very complex issue, and is beyond the scope of this study. To avoid confusion in the remainder of this paper, the context of effectiveness will refer to cost analysis only.

Distance Learning involves more than technology. It is a combination of people, process and technology that creates effective and efficient DL programs (Kidwell 1998). There is an underlying study of pedagogy that goes into determining what DL option, if any, makes sense for a particular course. Most DoD and service DL strategies recognize this requirement that training be student-centered, and not technology-centered. Questions remain, how should the military services decide whether to invest in DL programs? How should they determine in which technologies to invest? How should the DoD measure the value of those investments? What costs and benefits are relevant? The following review may help the reader understand the factors that contribute to arriving at a decision as to the applicability of DL solutions in a learning environment.

2. Synchronous versus Asynchronous Delivery

Distance education delivery systems are categorized as either synchronous or asynchronous. Synchronous delivery requires instructors and students to participate at the same time, while asynchronous delivery allows participation at differing times. The main advantage of synchronous delivery is the provision for live interaction and the possibility of more natural group processes. The disadvantage is the requirement to

adhere to a specific time frame that may not be convenient for all participants, especially those in other time zones (Steiner, 1995). Asynchronous delivery systems are characterized by the separation of the instructor and student in time. Asynchronous systems allow anytime-anywhere learning, but are more limited in student and instructor interaction.

As cited in Christensen, et al. (1998), Alan Chute points out that synchronous events are desirable in distributed learning programs in order to provide student-to-student interaction for peer learning, and student-to-instructor interaction for mentored learning. Additionally, synchronous events provide a framework of calibration and expectations to keep students on a scheduled track. Even programs that depend primarily on asynchronous learning benefit from periodic synchronous events. Christensen, et al. (1998) further discusses how synchronous learning activities leverage the great depth of expertise and qualities of the traditional classroom, while expanding the physical reach to geographically separated learners.

The key here is to be able in some way to quantify the benefits of a synchronous training environment versus an asynchronous one in order to determine which is the more appropriate and valuable for a particular set of circumstances. The following subsections list several additional factors that may contribute to potential returns on DL, which should be evaluated when assessing the worth of DL programs. These factors may impact either positively, negatively, or not at all, but should be considered nonetheless.

3. Benefits Of Potential Returns from DL

TIME SAVINGS. With DL, the amount of time students spend in training can be greatly reduced. The time previously spent in *travel* also becomes available for work or training. This time "compression" factor is almost always a positive result of course conversion to a DL format (Belcher, 1999). A well-designed DL program requires less student time to achieve learning objectives than does traditional classroom instruction. (An additional value-added result of this process is that the course Program Of Instruction (POI) is often updated or modified during the conversion process, resulting in a shorter overall course.) Belcher (1999) states that asynchronous learning allows students to skip ahead if they already know some of the material. He further suggests that because students can progress through these lessons at their own pace, comprehension may be enhanced. Some technologies allow students to return to material on the job as refresher

training. Studies conducted by the Institute for Defense Analysis suggest that this compression is typically about 30 percent for most forms of DL and is occasionally as high as 60-70 percent (Metzko, 1996; Howard, 1997). For the purposes of this study, the more conservative value of 30 percent will be used.

UNIT READINESS. Trainers argue that the ultimate objective of any military training or education course is to bolster readiness (and subsequently, performance) of military units. The Army's DL plan says as much (TADLP, 1999). DL technology enables trainers to claim these readiness benefits:

- Because some training can be extracted from schoolhouse-based instruction and done in the operational units, recruits can spend less time at initial schooling and be assigned to operational units faster. They would then receive the additional training later as required.
- Units can get larger portions of their organizations trained on critical subjects. Since students take less time to learn some distance learning courses, they spend less time away from unit duties and training than if they took traditional classroom instruction. Personnel are also available in the event of an emergency. The result is improved overall readiness.
- The ability to take training with them (e.g. on a laptop computer) enables units to keep personnel even during major field exercises and deployments, enabling the personnel to continue training.

ANYTIME, ANYPLACE TRAINING. As mentioned before, one of the ways for DL to be student-centered is for the student to decide how learning takes place. The most efficient DL programs will give the student volitional control over when and where to train. With minimal support equipment, some distance learning technologies enable trainees to access courseware at the time and place of their choosing. Computer-based Instruction (CBI) and CD ROM-based instruction require only a computer of modest capability. Internet access naturally extends that accessibility to Web-based instruction.

ENHANCED COHESION AND MORALE. With DL, trainees spend more time at home stations, near friends and family, which enhances morale (Belcher, 1999). This is particularly true for Navy shipboard personnel who spend much of their time afloat. Distributed courses thus allow for more student and/or course flexibility over conventional schoolhouse training. The advantage is tempered somewhat from the unit's perspective, however, by the need to provide personnel duty time to complete required training.

REDUCED TRAVEL COSTS. The most widely reported monetary benefit of DL is that reduced in-residence classroom instruction minimizes the requirement for trainees to travel to schoolhouses. Depending upon the size of the training audience and the length of the course, this can reduce travel and per diem costs. Travel and transportation savings can be compounded when training units use linked simulations or networked simulators. The cost of transporting entire units and their equipment to a central training area can be avoided (Belcher, 1999).

INCREASED EFFICIENCY. Although initial costs for many forms of technology and course conversion are high, they can be offset by higher course enrollments over time. The increased number of people trained therefore, can thus recoup the start-up costs more quickly. An increasing portion of future training infrastructure will be virtual. Requirements for traditional schoolhouses and training facilities will diminish, reducing overall infrastructure costs. Finally, the groundswell for Distributed Learning is driving the market toward lower-cost solutions. As competition between providers heats up, technology improves and hardware and software costs will decline.

4. Costs of Potential Returns from DL

The costs associated with particular DL programs/technologies entail equal consideration and include some of the following factors:

COURSE CONVERSION COSTS. Costs that should be considered when assessing possible conversions are hardware, software and transmission conversions, as well as time needed to train faculty and staff (Martin & Bramble, 1996). On the plus side, technology-driven items such as hardware and software items are decreasing, but facilities and communications infrastructure costs may apply for selected new courses. Doing the work of conversion in-house can minimize course conversion costs. The two principal considerations to lower course conversion costs are to have the course up to date with good presentation material, and to have well-developed standards and guidelines for the courses (Payne, 1996).

SUPPORT COSTS. For asynchronous Web-based training, building and maintaining a Web site requires planning for system maintenance and availability. If students are located around the globe, the site should be hosted at a location that provides 24 hours per day, 7 days per week support. For synchronous training, technical support personnel must be on-hand during sessions. Instructors and students may be working

within narrow schedules, resulting in a domino effect if lessons are delayed with no rebroadcast (Robinson, 1998). Costs are also associated with "training the trainer." DL instructors must be more organized than classroom instructors. DL instructors require in-depth knowledge of course material *and* of the training technology. Some forms of DL, like VTT can be relatively expensive to operate and maintain, but these costs often are overshadowed by the travel cost savings and the ability to train larger numbers of students simultaneously (Belcher, 1999).

STUDENT EQUIPMENT. As DL becomes computer and Internet based, Internet-capable student computers become an absolute requirement to access instruction. Unfortunately, not all students own or have access to these machines (Robinson, 1998). Training planners should account for the cost of equipment required by the students, or alternatively, they must ensure that such access is afforded to students. As the equipment requirements change over time, DL planners must determine how the school or course will keep up with those changes.

5. Neutral Factors that May Influence Returns from DL

Planners should further be cognizant of various considerations that fall neither in the benefits nor costs categories. Many of these issues surface as causes for concern for organizations currently grappling with DL implementation issues.

ACCOUNTING FOR INVESTMENTS. Distance Learning conversions are often the products of various initiatives at various levels and funding sources. Organizations making the investment in learning may not necessarily be the same organizations reaping the benefits (ODUSDR, 1999). Hardware and software supplied as government-furnished equipment (GFE) to DL programs and developments that result from multiservice or government/industry collaboration further complicate the investment chart of accounts.

MATCHING NEEDS AND TECHNOLOGY. Trainers must be careful not to let technology drive strategy. There is a risk that plans will be made and technologies selected before the requisite analysis is performed. A careful match of the training needs and the technology available should result in cost savings. According to Sherry (1996), "too often, instructional designers and curriculum developers have become enamored with the latest technologies without addressing the underlying issues of learner characteristics and needs; the influence of media upon the instructional process; equity of

access to interactive delivery systems; and the new roles of teacher, site facilitator and student in the distance learning process." Student characteristics also must be considered when designing a course (i.e., independent work without supervision, number of low cognitive tasks, etc.). The student, not the technology, should be the focus of the design (Belcher, 1999).

COMPLICATED RESOURCE SCHEDULING. Particularly for VTT courses, both transmission and downlink site availability must be coordinated for each class. This task can be complicated for synchronous training courses transmitted to remote locations over several time zones. Such off-hours staffing and operations add to operations and support costs (Belcher, 1999).

SCHOOLHOUSE IMPACT. Traditional schools must digest a new philosophy. Training must now follow a decentralized, student-centered model. Belcher (1999) states that training should be designed for how students learn, not for how schools teach. To him, flexibility is the key. In a student-centered model, the school must be flexible enough to respond to the needs of the individual learner. Since DL courses yield higher student throughputs, they can create backlogs or bottlenecks for other related training (Metzko, 1996). Schools may make portions of a course available to students via DL technology, but they may not produce more trained personnel because a subsequent phase can only accommodate a few trainees (Belcher, 1999). As such, a more holistic view of the training and education process must be considered when implementing DL solutions. Furthermore, resource managers need to consider new ways to budget for schools. In the past, military service schools were allocated resources based on student throughput. In the DL environment, this approach may no longer be an appropriate measure. School budgets should now focus on the number and type of courses the school must convert and execute (Belcher, 1999). Finally, instructor training/certification requirements must be redefined. The new teaching environment dictates that instructors be certified to teach using current DL technology. Critical issues here center on instructor competency with hardware/software components, as well as flexibility in established teaching procedures and curricula.

Belcher's (1999) assessment is that drawing conclusions about ROI for DoD as an enterprise is complicated. Many initiatives have been undertaken across the services. Naturally, there has been some redundancy and duplication among them. It is reasonable to assume that eliminating duplication across the four services could equally reduce up-front investment costs (Metzko, 1996). The results, however, are not purely additive;

determining just what constitutes duplication is subject to interpretation. Case-by-case analyses are required to understand the synergies, opportunities and risks associated with determining ROI on DL.

C. COST-BENEFIT VS. COST-EFFECTIVENESS ANALYSIS

Cost analysis can help educational managers see the various options and trade-offs available to them and assess their merits and feasibility. It can reveal the possible advantages of redeploying limited resources between different levels and types of education, among different categories of inputs, and across different geographic areas. Cost analysis can uncover internal waste and recommend possible ways to eliminate it. It can also suggest ways to enhance the external productivity of the educational process and the benefits accruing to individuals from investments in technology and new processes.

Cost analysis must be combined with pedagogical analysis to assess the outcomes of any educational process. The key to judging the efficacy of an educational process lies in comparing the costs invested in it and the learning results attained. There is a difference between cost-benefit and cost-effectiveness. As Reynolds and Iwinski (1996) state, cost-benefit analysis is an attempt to weigh the costs of training against the outcomes achieved. Cost-effectiveness focuses on comparing the costs of two or more training alternatives, or examines ways to reduce a program's costs, while cost-avoidance involves simply cutting expenses to a set level. This paper is chiefly concerned with cost-benefit analysis. According to Gramlich (1998), the fundamental principle of cost-benefit analysis is that when choosing among programs, the best course of action is to choose the one that maximizes net benefits. To accomplish this, add up all the gains from a policy alternative, subtract all the losses and choose the option that maximizes the total benefits.

Since life doesn't always present simple alternatives, however, there are some additional guidelines to use in applying this fundamental rule. According to Gramlich (1998), one should not compute cost-benefit ratios. He feels that the right measure of the gains or losses to society is program *net benefits*, and the cost-benefit ratio can be a misleading guide. His second rule of thumb is that a cost-effectiveness test can be used to get around missing information when the investigator is comparing *two or more* ways of accomplishing an end. A third consideration is that when projects are packaged together, the net benefits test should be applied to the whole package (Gramlich, 1998).

Cost-benefit analysis is a framework for comparing the pros (benefits) and cons (costs) of project choices. Benefits and costs should be quantified whenever they can be and (obviously) not when they cannot be; but whether quantified or not, they should never be ignored (Coombs, et al., 1987).

D. COST-BENEFIT TECHNIQUES

According to Reynolds and Iwinski (1996), there are four considerations ordinarily used to analyze cost-benefits:

BENEFITS. Quantifying benefits is a challenging task, because the outcomes of training are often intangible or difficult to translate directly into dollar amounts. Factors such as increased student throughput, reduced travel and per diem expenses and savings in realia expenses (i.e., the cost of using real things such as ships or aircraft) come most readily to mind. Job performance or organizational results, although difficult to quantify, oftentimes more accurately justify a new training program, and can be expressed in financial terms as well. Most technical training is much easier to quantify than management training because it is directly linked to processes and products with known or measurable value.

LIFE CYCLE. One of the basic elements of CBA is life cycle cost. *DoD Instruction 5000.2* (DoD, 1991) defines life cycle cost as follows:

> Life-cycle cost reflects the cumulative costs of developing, procuring, operating, and supporting a system. They are often estimated separately by budget account (i.e., research, development, test, and evaluation…, procurement, and operations and maintenance). It is imperative to identify life-cycle costs, non-monetary as well as monetary, associated with each alternative being considered.

Costs accrue over the life of a system. TRADOC divides this life into five distinct but sometimes overlapping phases (Department of the Army, 1985):

- Conceptual (exploratory development): Solicitation, evaluation, and exploration of alternative concepts.
- Demonstration and Validation (advanced development): Prototypes are produced to support demonstration.
- Full Scale Development (engineering): Prototypes are produced to support operational test and evaluation.

- Production and Deployment
- Operation and Support

Often you can only determine true cost savings by considering the entire lifetime of the training project. The life cycle model is shown in Figure 3.1. The life cycle method's strong point is that you can evaluate the total costs of each of the planned program's phases to determine whether it will result in a net cost savings. Figure 3.1 illustrates the expenditure profile for a typical training project. Expenditure corresponds to new implementations. The figures show that some money must be spent before anything occurs. These costs are labeled as research and development even if no research is involved. The next phase is called startup and marks a sharp rise in money spent on the training technology since it has now come of age. The operational period, sometimes referred to as the "steady state," is the main period during which the program is active (Reynolds & Iwinski, 1996). This time frame is much longer for some technologies than for others. Often a program that performs its function well and remains current, is delivered by an obsolescent technology for years. Finally, as the program ages, it is gradually phased out or eliminated during the decline phase. This process is normally accompanied by a simultaneous transition to a new program.

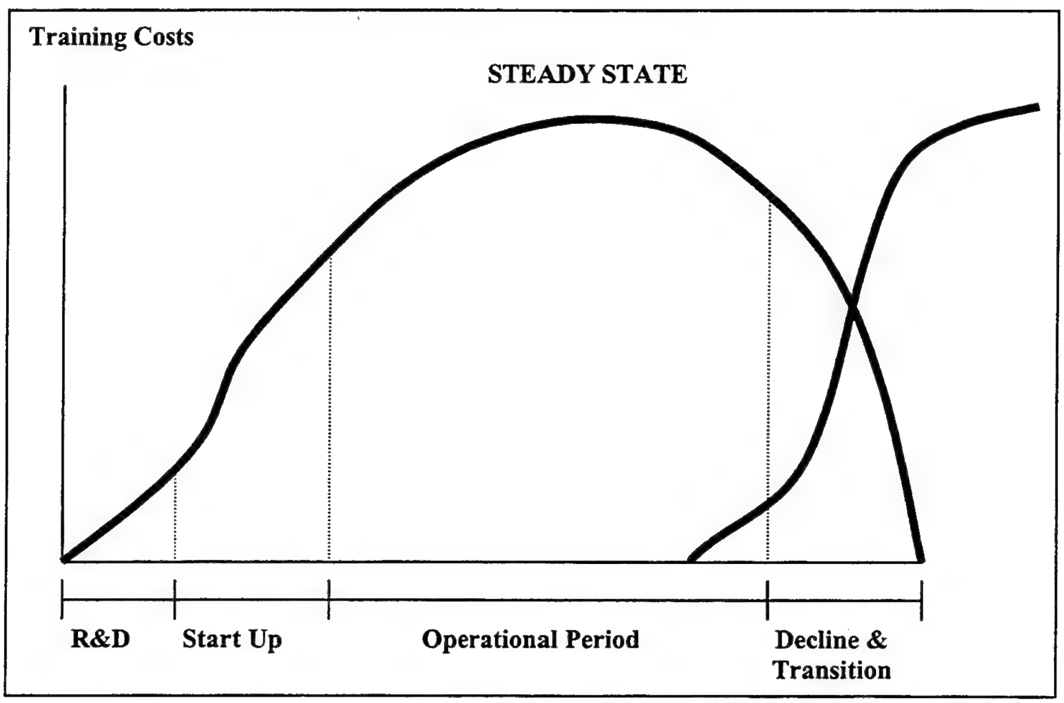

Figure 3.1 Technology Life Cycle from Reynolds & Iwinski (1996)

PRODUCTIVITY. This consideration compares both a program's efficiency and its effectiveness. It may be used to demonstrate that a project reduces training costs or increases training. A productivity analysis can determine when to switch from one training approach to another, or when further application of a particular approach will no longer produce cost-effective improvements.

RESOURCE REQUIREMENTS. This component is the simplest and most direct way to compare the costs of two or more different training approaches at a given time (Reynolds & Iwinski, 1996). One merely determines the costs in four major categories for each Instructional Systems Development (ISD) phase (analysis, design, development, implementation and evaluation) of the particular training project. Make use of the cost categories *equipment, facilities, materials* and *personnel.* The result of the analysis will include the total costs for each phase and category. Resource requirements work well in comparing a potential new method with an existing one, assuming that both applications will be equally effective. To compare two possible approaches, one simply adds the total costs of each for all phases and resource categories. Resource requirements are limited to training costs, however, and should not be used to compare effectiveness. To properly conduct a worthwhile cost analysis, one must understand the various factors that comprise cost estimation. The following section will review some simple fundamentals of cost analysis to include basic economic principles and intangible influences.

E. COST ANALYSIS IN TRAINING DEVELOPMENT AND ROI

1. Cost Estimation

Cost estimation should take into account several economic factors. The following is distilled from a description of key factors in Adams and Rayhawk (1987).

- *Opportunity Costs versus Accounting Cost:* Accounting Cost is the cost "on the books." Opportunity cost is a hypothetical value of a resource in it "best alternative use."
- *Sunk Costs:* Costs that have already been incurred and that cannot be recouped. An example is the cost of R&D spent on various forms of technology.

- *Fixed and Variable Costs:* Fixed costs are not affected by how much training occurs. An example would be the cost of classroom space. Variable costs vary with the amount of training. An example would be the cost of instructors, whose number would vary with the student load.
- *Time Value of Money:* The value of money changes with time because money has earning power. This is considered when comparing alternatives whose expenses are incurred at different rates over various periods of time by estimating both costs in terms of "present value" dollars.
- *Discount Rates:* Costs that can be deferred into the future can be discounted because a smaller amount of money could be invested today and earn interest to make the future payment.
- *Constant versus Current Dollars:* The purchasing power ("current value") of the dollar varies with the general price level and inflation rate. Constant dollars reflect the purchasing power of the dollar in a selected base year.
- *Residual Value of Assets:* The value, if any, left after a system has completed its life.
- *Indirect Benefits:* Benefits that may occur beyond the intended scope of training. For example, the value of training to military personnel in preparing them for a civilian occupation (Simpson, 1995).

2. Common Cost Factors

Reynolds and Iwinski (1996) state that the most common cost factors that affect the development of training programs, and impact on ROI include the following:

- Instructional strategy. Technology-based strategies cost more than cramming students into a large room and talking at them, although initial up front investment costs may be easily offset by increased student throughput.
- Existing course modification or new course development. (New courses cost more to develop, particularly in terms of instructor time.)
- Amount of existing information.
- Amount of individualization.
- Type(s) of media used (Higher technology media cost more than simpler technology.)

These factors should not be evaluated individually, as they often occur in combinations, and thus affect the outcome of a training program accordingly.

The cost of training technology can be substantial, but perhaps not as severe as the costs associated with poor human performance within operational environments that involve human safety and well being. Mattoon (1998) applies a disparate set of metrics in his evaluation of ROI on training technologies. Several factors affecting both cost and those less tangible benefits of effective training include the following:

1. Acceleration. Does the system accelerate the rate at which the learner acquires knowledge and skills?
2. Automation. Does the system support the reduction of instructor workload?
3. Availability. Does the system increase availability and accessibility of training for learners?
4. Generalizability. Is the system effective for a variety of different types of learners?
5. Longevity. Does the system contribute to greater retention of knowledge and skills?
6. Stability. Does the system exploit current technological capabilities, emerging capabilities, and others that are likely to come about in the future?
7. Strategics. Is the system applicable across multiple training environments?
8. Transfer. Does the system increase learners' readiness to perform in the operational environment?

Mattoon's approach to developing learner-centered design principles for Information Technology (IT) applications is based on a synthesis of research on learning, training and instruction, human factors engineering and human-computer interface design. His findings were used to identify what Mattoon called "General Facilitative Links" (GFLs). This term describes the relationships between technological capabilities and learning processes that can be leveraged to improve knowledge and skill development. The end result of such leveraging is an increase on ROI for training. The "General" component of a GFL principle indicates its applicability across many different learners and training environments. The "Facilitative" term indicates the potential positive impact a particular technological capability can have on knowledge and skill development. The "Link" component indicates the successful realization of this potential through effective design and implementation of Information Technologies. Each of seven specific GFLs are matched to the particular ROI factors discussed above. Table 3.1 illustrates this relationship between the GFLs and the ROI cost factors.

GFL	IT Capability	ROI Factors
1. Instructional Simulation	Combines instructional intervention with dynamic representations of conceptual material and criterion tasks.	1, 2, 4, 5 , 6, 8
2. Hyperlinked Content	Links words, examples, descriptions, and other components of content information together into a structure that depicts the type of mental model learners are intended to develop.	1, 2, 3, 6, 7
3. Distributed Training	Employs network technologies to increase the availability and accessibility of instruction, proficiency profiles, and other training materials and tools.	1, 2, 3, 6, 7
4. Verbal-Visual Pairing	Combines abstract and concrete representations of concepts, factual material, task components, and relevant factors to facilitate information encoding and retention of knowledge.	4, 5, 6, 7
5. Multi-modal Delivery	Presents information in at least two modes (e.g. audio dialogue and visual imagery) to activate selective attention and provide for simultaneous processing of information.	1, 2, 4, 5, 6, 7, 8
6. Proficiency Tracking	Monitors learner interactions, captures data, analyzes performance, and summarizes individual progress and instructional needs within Proficiency Profiles	1, 2, 4, 6, 7
7. Instructional Control	Uses Proficiency Profile information to automatically adapt instruction, provide advice that helps learners control instruction, or regulates shared control between learner and the IT program.	1, 2, 3, 4, 6, 7, 8

Table 3.1 General Facilitative Links Matched to Instructional Technology Capabilities and ROI Factors from Mattoon (1998)

There are many potential GFLs that can be identified to help promote the design of more effective training. Because GFLs represent general principles, continued identification of new GFLs is likely to continue and lead to one of two outcomes: (a) the range of applicability of GFLs will begin to overlap to the extent that individual distinction among them becomes academic rather than practical; or (b) the degree of generality or breadth of application of each GFL will become more specific. According to Mattoon (1998), the latter outcome is more preferable, because it leads to the identification and application of "Specific Facilitative Links" (SFLs). SFLs would provide more detailed and clearly defined boundaries for application to specific training

curriculum and challenges. The same logic holds for the identified ROI Factors that may be constrained to specific priorities, cost drivers and goals of a particular training operation. This degree of specificity is necessary before cost-benefit analysis can be effectively applied to training technologies to accurately predict ROI (Mattoon, 1998)

F. MEASURES OF EFFECTIVENESS FOR ROI

In any orderly process designed to provide a solution to a stated need, there should always be a provision for answering the question "How do I know if I have succeeded?" The way to do this is to establish measures against which the solution(s) will be tested and evaluated (Sproles, 1997). When used in conjunction with test and evaluation, measures are units for the quantification of qualities of the system or entity under review. Based on extensive research conducted by Donald Kirkpatrick (1994), the U.S. Navy has applied their own version of Measures of Effectiveness (MOE) to training technologies to better gauge their probability of success. According to a draft CNET Instruction on ROI for training program investments (CNET INSTRUCTION 3920.1J, 1 April 96), the U.S. Navy recognizes four different levels of ROI analysis that can be conducted when evaluating a potential program. Student and instructor reaction is the *first level* of analysis and is also the most commonly used method of evaluating training effectiveness; so much so, that it is considered a default MOE. Student learning achievement is the *second level* of training effectiveness evaluation. Student learning achievement is the most important quality indicator; however, student learning is influenced by a large number of external variables that are viewed as outside the trainer's control (e.g., attitude, motivation, aptitude and transfer environment). Consequently, measures of learning are most reliable when they are taken inside the system in which the trainer does exercise control (e.g., in formal schools versus in the fleet). Evaluations of student performance in the fleet thus encompass the *third level* of training effectiveness evaluation. It should be noted that this type of performance analysis is extremely expensive to conduct correctly, as it attempts to control for variables that in many cases have nothing to do with training quality in the schoolhouse, and is therefore considered highly unreliable. These first three levels together make up what is termed *the quality improvement measures of effectiveness*. Specific factors that comprise this MOE include the following:

1. Quality Improvement Measures Of Effectiveness
   a. Final course test scores
   b. Follow-on course test scores
   c. Reductions in academic review boards
   d. Fleet returnee feedback (Subjective, Qualitative)
   e. Student course critiques (Subjective, Qualitative)

The next level of analysis forms the core of the CNET Training Technology ROI procedures. These measures address the business results and financial impact of training technology investments. According to the instruction, progress against the upcoming Program Objective Memorandum (POM) Individual's Account reduction goals are measured against *timesaving measures of effectiveness.* Direct cost savings are measured using *cost savings measures of effectiveness.*

2. Time Savings Measures Of Effectiveness
   a. Reduced Individual's Account expenditures
      (1) Implemented reductions in course length
      (2) Reductions in average on board (AOB) resulting from:
         (a) Reductions in students awaiting training
         (b) Reductions in students under instruction time
         (c) Reductions in interrupted instruction time
         (d) Reductions in students awaiting transfer time
   b. Reductions in attrition
   c. Reductions in setbacks
   d. Reduced TAD/TDY transit time
   e. Reductions in instructor personalization and course revision time

3. Cost Savings Measures of Effectiveness
   a. Reductions in training consumables
   b. Reductions in overall TAD/TDY/PCS costs

Based on these direct and simplified MOEs, the Navy's intent is to provide an easily understandable, systematic and consistent management tool whereby the Chief of Naval

Operations (CNO) and CNET can measure the efficiency of training technology investments and thus compare progress against predetermined budget reduction goals.

G. CHAPTER SUMMARY

Distance learning is not just about technology. It is not a singular strategy, but is a *part* of an integrated strategy for training. The *learner*, not the technology should be the focus of effort. This concept is fundamental, so when assessing returns one should concentrate less on the *costs* to the *trainer* and more on the *benefits* to the *trainee*. As previously mentioned, however, these benefits may sometimes be difficult to accurately measure.

Return On Investment for a military service course is especially difficult to define and compute for a number of reasons. Many relevant factors are not easily quantifiable in monetary terms. Moreover, returns are not always clearly stated in monetary terms. The one benefit touted most often is that DL saves student transportation and per diem costs. The most interesting data found by Belcher (1999), however, was not that DL courses save money (although most do), but that they provide other benefits. These other benefits range from time saved to improved training. Factors like time-to-train, flexibility of usage and impact on unit readiness should weigh heavily in a student-centered assessment.

Drawing "before and after" conclusions about the introduction of DL into a curriculum can prove complicated because costs directly related to converting a course to a DL format are difficult to isolate. Reasons for this include the fact that many organizations that convert courses to DL formats often use the same opportunity to update or change the course's program of instruction (POI). The resultant course may be completely different from the original course. If these course changes were predictable and consistent, then they could be incorporated into ROI estimates a priori. Unfortunately, they are most often not, so estimating the final ROI traceable to the technology insertion is difficult. Thus many course conversion costs and funding sources are hard to isolate. Course modification often is coincident with DL conversion, while some conversions are actually new courses or only partial conversions. Courses may not be completely converted. In some instances, schools have chosen to convert only portions of a POI to DL format. They believe it is necessary to maintain some of the classroom instruction because of the nature of the particular training (Belcher, 1999).

Some courses are designed from scratch as DL courses. In those instances, of course, there is no training "before" state with which to compare the benefits of the new course (at least, none that would not be realized, at least partially, by instituting a classroom-based course). The components of a DL conversion may be the products of multiple contributory resources or from different pots of money. For instance, an Army VTT course may be the beneficiary of proponent school courseware funding, a training support center paper, or CD-ROM read ahead materials. Additional competing sponsors/users may include the Training and Doctrine Command, the Army Distance Learning Program Manager, National Guard-funded VTT classrooms, or even DoD-funded satellite time each with their own agenda (Belcher, 1999). Finally, much data relevant to determining ROI are not collected. Success stories often collect data on only one aspect of training (e.g., reduction in student training hours) without tracking the cost of development, cost of fielding, cost of operations and maintenance or student test results.

To provide the reader with a better perspective and understanding of the numerous factors pertinent to cost analysis of training and education programs, this chapter focused on specific issues that have been found to impact on ROI for DL courses. Information is provided briefly outlining the differences and appropriateness of CBA versus CEA in evaluating alternatives, followed by a discussion of suitable cost-benefit analysis techniques and common terminology. Although some studies conclude that there is no significant difference in the ultimate learning effectiveness between classroom instruction and Advanced Distributed Learning-enhanced instruction (Russell, 1999), the issue is not a foregone conclusion. Much debate continues over this contentious point, particularly in regard to the MOEs that may be used in an analysis. In spite of this disagreement, however, there are clearly identified increases in efficiency that if applicable, should be included in any assessment of DL programs. Accordingly a list of MOEs commonly used by the U.S. Navy for training and education programs was included as well.

IV. PRELIMINARY OBSERVATIONS

A. METHODOLOGY

To gain a perspective of how DL initiatives and Interactive Multimedia Instruction (IMI) technologies have *actually* been applied to date by the USMC, I chose to review the curricula of selected courses currently taught at the Marine Corps Communications and Electronics School (MCCES), located at the Marine Corps Air Ground Combat Center (MCAGCC), 29 Palms, California. My purpose for choosing this particular location was based on the following criteria:

(1) MCCES presently has one of the most advanced, state of the art training facilities in terms of implemented training technologies, as outlined in the USMC's Strategic Roadmap for DL and CBT.
(2) The variety of courses taught at MCCES are among the most lengthy and challenging within the USMC, ranging from several weeks to over a year in duration.
(3) The quality of the instruction provides skills that are in high demand in both the USMC and civilian industry. Turnover in these particular technical MOSs is frequent, resulting in relatively high and consistent student throughput.
(4) While functioning as an FLC, MCCES has been further designated as one of only two RDCs that will support all training development for the West Coast. Moreover, with the installation of a TEPOP server, MCAGCC serves as an ALC, and additionally has a fully functional VTT facility. In short, all the critical components of the USMC's DL program are in place at this single location.

As previously discussed, the four categories of learners found within the USMC's organizational hierarchy consist of the following:

(1) Initial skills training, to include recruit training, Marine Combat Training, and MOS school.
(2) Advanced skills training.
(3) Professional Military Education.
(4) Marines Awaiting Training.

For the purpose of this paper, I chose to limit my research to categories (1), (2) and (4). Debate continues over the applicability of DL initiatives to entry level skills

training. I therefore conducted my analysis of two training companies within MCCES; Company A, which trains technicians and maintenance personnel, and Company B, which trains equipment operators. Within each of the companies, I further focused my research on an entry-level course and an advanced skills level course, looking for specific problem areas.

The courses reviewed in Company A were the Basic Electronic Repair Course, an introductory level course designed to provide students with elementary concepts of electricity, electronics, digital logic, computer operation and basic electronic construction techniques. This initial instruction provides the foundation for further training in the maintenance of telecommunications or electronics equipment and eventual qualification in MOSs 2800 or 5900. This course must first be successfully completed before the student can progress to the next phase of training. I next looked at the Technician Theory Course, which consists of advanced level training for senior Marines, in which students are introduced to sophisticated aspects of transmission theory and applications and provided instruction in advanced digital technology.

Following a similar approach in Company B, I reviewed the Basic Field Wireman's Course, which provides entry-level instruction in the operation of analog and digital wire communications equipment. I then looked at the Communications Systems Chief Course (CSCC) and the Operations Communications Chief Course (OCCC). The CSCC provides advanced level instruction in the three primary communications systems that the USMC currently uses; radio, wire and data networks; while the OCCC trains students in communications planning, including information on the organization and employment of USMC command and control systems, as well as routine communications support.

I looked at such factors as total student throughput, failure and remediation rates, changes in interactive-engagement methods, student-to-instructor ratios, reductions in overall course hours and the potential for DL applications for each course both before and after the inclusion of CBT and IMI technologies. To gain a better understanding of these issues, I interviewed over two dozen instructors and administrative personnel, officers, civilians and enlisted alike, from both of the training companies, as well as support personnel from the MCCES staff. I also questioned the system administrators who supervised the LRC at MCAGCC. The experience levels of the interviewees varied, with some individuals having been present at the schoolhouse for a couple of years, both before and after the implementation of CBT in the classroom, while others had only just

recently arrived. The variance in experience levels, combined with the degree of seniority and knowledge of the personnel involved, provided an accurate representation of the differing opinions regarding the inclusion of CBT in the classroom, allowing me to accurately capture many of the concerns surrounding training technology issues. I further reviewed the problem of Marines Awaiting Training, focusing on how information technologies, to include DL, have addressed this issue. Finally, I examined the use of the LRCs, both at the schoolhouse and the base, to identify any trends in the levels of use since they were opened.

B. OVERVIEW OF MCCES

The training constraints currently faced by MCCES originate from the guidance provided by former Commandant, General Charles Krulak (Krulak, 1995), for all formal schools to reduce the time Marines spend in entry level training, in order to get them to operational units faster, thus reducing the overall number of Marines in the T2P2 account. The more time junior Marines languish in a training status, the less return the Marine Corps can expect from its recruiting investment.

Based on the personal anecdotes of instructors and administrators, the planned reductions in individual course length, for example, were not carefully considered, in many cases resulting in arbitrary reductions in various courses. Procedures for formal course revisions, as outlined in the Systems Approach to Training (SAT) manual, were ignored. Input from Subject Matter Experts (SMEs) regarding the retention or elimination of Individual Training Standards (ITSs) from a particular course of instruction, and normally reviewed during a Course Curriculum Review Board (CCRB), was not requested. In some cases, the training companies were directed to reduce overall course lengths by an across-the-board percentage without regard for what would be eliminated. It was felt that new CBT and DL technologies would increase the overall efficiency of the learning process, as conventional classroom time was reduced. As a consequence, however, some courses were cut too deeply with reductions as great as 50 percent of critical ITSs completely removed. When asked for their opinion on whether CBT has made up for the reductions in conventional classroom time, responses were mixed. Senior instructors felt that CBT, although useful, was not a substitute for the mandated reductions in conventional classroom time. Junior instructors favored CBT and felt that it improved overall instruction in terms of learning transfer and retention. These

junior instructors had been teaching prior to the activation of the Automated Electronic Classroom (AEC), and had the benefit of conventional classroom experience.

Instructors reported that frequent complaints were received by MCCES from operational units regarding the training of junior Marines arriving from the schoolhouse since the activation of the AECs. Taking into the account the experience level of senior non-commissioned officers in the operational units, senior instructors and administrators from the schoolhouse determined that most of the complaints were unfounded and based mainly on conjecture, as the experience levels of junior Marines arriving prior to the use of CBT were never evaluated. No baseline therefore existed against which to make such claims.

The current period under observation (Winter/Spring) was considered the busiest time of the year in terms of student throughput for the schoolhouse. Larger numbers of Marines recruited during the summer months (after graduation from high school) having completed recruit training and Marine Combat Training (MCT), were now receiving entry level MOS training. In accordance with the TEMI, the fielding plan for the acquisition, installation and operation of an integrated telecommunications system for distribution of IMI and training software was on schedule. The hardware and software components of MCCES and MCAGCC are currently in place and fully operational. Accompanying changes in the traditional methods of instruction to include course length, curriculum content and delivery mechanisms had only recently been completed and implemented the preceding summer. Little had been done prior to my visit to implement formal DL solutions to improve instructional effectiveness. There was unanimous agreement that DL technologies should not be applied to entry level skills training. They should be used for advanced skills *(core plus)* level courses.

C. COMPANY A

Company A provides training for technicians and maintenance personnel. The entry-level course reviewed was the Basic Electronic Repair Course (Course ID# M092721). Course length is approximately 40 training days. Class capacity ranges from a minimum of 15 students to a maximum of 30 students. There are 50 classes held per year with an average annual throughput of 1300 Marines. This figure is in accordance with the Training Input Plan (TIP), which estimates an annual throughput of approximately 1325 Marines for FY01. It should be remembered that this is a feeder

course for further entry level training, so depending upon the individual Marine's particular MOS (either 2800 or 5900 field), additional training time may last over a year (Herring, 2000).

1. LABVOLT Experiment

This course was of particular interest to my study due to the use of some innovative automated electronic training technologies that had been recently instituted. Known as *LABVOLT*, this technical training system features educationally substantive, competency-based curriculum providing hands-on activities for learning, testing, troubleshooting, applying and designing basic-to-advanced electronic circuits. The system consists of a breadboard of basic electronic circuits connected to an interactive computer program designed to walk the student through each lesson. The system offers stand-alone capability in which the student can progress at their own pace, as well as a test and remediation package that guides the student through each progressive skill level. Based on discussions with course instructors, this particular system was designed for civilian schools and has been used with success by the ITT Technical Institute and DeVry Institute of Technology. It was pointed out that many of these institutions furnished only one computer for two to three students. This was felt to be inadequate for this type of instruction. Accordingly, the number of students per class for the Basic Electronic Repair Course was capped at 27 to ensure a terminal-to-student ratio of 1:1 (Weber, 2000).

A study at the Marine Corps Training and Evaluation Branch revealed that since the application of this technology, the overall course length was reduced from 55 to 40 days, but most interestingly, the overall recycle/failure rate was reduced from approximately 46 percent to 6 percent. Upon closer inquiry with instructors and staff, it was revealed that the results were even more impressive. Under the traditional lecture method, approximately 80 percent of the students were set back at least once during the 11-week course. After the full implementation of the *LABVOLT* curriculum, setbacks were reduced to 15 percent. The attrition rate remained about the same. As impressive as these results were, however, it was soon discovered that although the system was designed to stand alone, after-action comments from students indicated that difficulties were still being encountered in terms of learning transfer and retention. As indicated in the Program of Instruction (POI) for this course, the number of instructors per class was two. Apparently, while the instructors were busy answering questions and helping the

more vocal students experiencing difficulty, others would grow impatient and simply press on through the program without waiting to have their questions answered. This problem came to light when instructors later went back and checked the progress of the students. The program was designed in such a way so as to see exactly where each individual student experienced difficulty, if any, by the way in which the questions were answered (DeLeon, 2000).

As a result of these initial experiences with the *LABVOLT* system, it was decided to reintroduce lectures back into the POI to aid in retention of basic information. This action not only increased retention, but also actually allowed the students to progress through the lessons at a faster rate, so no time was lost in the overall schedule. The instructors felt that the use of such lectures prior to the start of each period of instruction oriented the students and enabled them to better understand and comprehend key concepts and ideas as they continued independently. It was also found that the overall number of questions significantly decreased when the lectures were reintroduced (Weber, 2000).

2. Marines Awaiting Training

Another area of interest concerned how Company A had addressed the issue of Marines Awaiting Training (MAT). Through the use of such technology as outlined above, the Company was able to reduce its MAT status from an average of four months to an average of 30 days (An overall reduction of 75 percent). Much of this reduction was attributed to the faster progression rates the students experienced as a result of the *LABVOLT* system. Upon closer examination, however, it was found that much of this reduction in MAT was achieved by conducting the course 24 hours/day, in shifts, with half the instructors providing instruction during the day, and the other half teaching at night. Although successful in significantly reducing the numbers of Marines in MAT status, the problems encountered included such issues as equipment breakdown from overuse and lack of scheduled maintenance; instructor burnout and exhaustion; and most importantly, rather than being eliminated, the MAT issue was only shifted to a follow-on phase of the Marine's training, as the other courses could not handle such large throughput at the same rate. As a result, the number of courses per year was reduced to current levels (DeLeon, 2000).

An alternative approach to this problem used by Company A was to provide the Marines in MAT with follow-on training that had previously taken place within the first six months that the Marines arrived at their operational units. Training included events such as uniform refitting, gear accountability and inspections, physical fitness, drill, core value instruction, sexual harassment training, etc. Not only does such activity keep the Marines suitably occupied, but also allows the Marine to be put directly to work upon reaching his permanent duty station. This approach has received favorable endorsement and feedback from operational units. Unfortunately, this technique was not in practice throughout MCCES, as each training company exercises its own method of handling the MAT issue. Current figures for the Basic Electronic Repair Course at the time of this research consisted of 434 Marines currently in formal training, 152 in MAT status (informal training), and 10 personnel-awaiting disposition (i.e., possible failures/recycles). Obviously, the issue of MAT was not a problem for the advanced skills level courses due to smaller student throughput and scheduling practices.

3. Technician Theory Course

The Technician Theory Course (TTC) (Course ID # M09TA31) is approximately 80 training days in length. As mentioned, it is an advanced skill level training course designed to provide instruction to Marines in the grade of Corporal through Gunnery Sergeant on a second or subsequent enlistment. According to the Course Descriptive Data (CDD) sheet, student capacity ranges from a minimum of 12 students to a maximum of 24 students. There are 10 classes held per year with a total student throughput of 188 Marines per year, which is in accordance with the TIP. Each individual class averages 24 Marines. This course has also been fully converted for use in an Automated Electronic Classroom (AEC) environment, although the specific lessons are not fully interactive as in the *LABVOLT* example. As an advanced skill level course, providing *core-plus* training, DL applications were viewed favorably by instructors and administrators alike. Based on interviews with schoolhouse personnel, it was determined that as much as 50 percent of the current curriculum could be disseminated via DL technologies, thus reducing overall course length significantly (Herring, 2000). Not only would prospective students be able to review and validate much of the introductory information, they would begin the course on a relatively level playing field in terms of knowledge and thus be able to absorb follow-on material much more quickly.

A word of caution is in order here, however, regarding course length reductions based on predicted savings from DL applications and other automated training technologies. One of the greatest frustrations expressed by instructors and administrators alike was the inclination of HQMC to mandate reductions in overall course lengths based on predicted savings from advanced training technologies. Particularly in regard to the entry-level courses, it was felt that time saved by the introduction of automation into the classroom should be used to provide additional training rather than eliminated from the curriculum. The reasoning was that junior Marines require as much exposure as possible, to the numerous systems currently entering the USMC's inventory that they will be required to operate and maintain. Under the current guidance to reduce training to the absolute minimum and get the junior Marine to the fleet as soon as possible, this is not taking place. Hence, the complaints from operational units that the overall quality of new Marines arriving from MCCES has dropped. This argument was not found to carry equal weight in regard to advanced skills training, however, as the key with more senior, experienced Marines, is to keep them in the operational units as much as possible where their expertise is needed. Advanced skill level instruction is a training niche for which DL seems exceptionally well suited.

Accordingly, measures are currently being developed to adopt this course to a DL format, although no specific date was set for this to occur. The predicted savings from such action were expected to be significant, based on the mythical training day cost of $271 per Marine. I enquired into the source of this $271 figure, seeking to determine where it came from, and upon what assumptions it was based. No one within Company A or MCCES could explain where it originated, or upon what assumptions it is based. Nonetheless, it is used frequently for budgeting purposes. It would therefore appear that although the estimated savings from the introduction of DL technology into this particular course may be substantial, the actual value will depend upon a determination of what it actually costs to train a Marine per day for this particular course. In all fairness to MCCES, however, it should be noted that using antiquated or inaccurate costing data is a convenient practice that occurs throughout military and civilian budgeting (Gramlich, 1998).

D. COMPANY B

Company B provides both entry-level and advanced skill training for communications systems *operators*. The Basic Field Wireman Course (Course ID# M092471), which was examined as an entry-level program, specifically furnishes instruction in the operation of Fleet Marine Force analog and digital wire communications equipment. It encompasses the application, installation, adjustment and familiarity with the operational characteristics and employment of wire/telephone equipment. Additional requirements of this course include demonstrated proficiency in communication procedures, and basic knowledge of relevant publications, directives and security regulations. Course length is approximately 17 training days. Class capacity ranges from a minimum of 20 students to a maximum of 40. There are 16 classes convened per year with an average annual throughput of 640 Marines, which in this instance was in excess of the TIP requirement of 596. The discrepancy can be attributed to the fact that the TIP has not yet been updated for this particular course, which was reduced in length from 40 to 17 training days.

1. Basic Field Wireman's Course

This reduction in overall course length represented perhaps the most extreme example that was found regarding the application of CBT in the traditional classroom setting. As such, there was also the most diverse range of opinions regarding the success of this action. There was general agreement among all the instructors, both young and old, that the course had indeed been cut too severely, leaving no time to teach many of the critical tasks and skills needed by the Marines to successfully function in their operational billets. For example, one of the key tasks omitted under the new reorganization was that of communications procedures. According to the instructor staff, when directed to implement overall course reductions in order to speed up the training process, the chain of command arbitrarily decided that these skills would be eliminated without regard for the advice of SMEs. It was determined that these skills could be acquired on the job, once the Marines reached their operational units. This was clearly another example of where the SAT process was completely ignored and key skills were eliminated in the interest of saving time. Although the intent may have been sound, this action was flawed because the advice and experience of the SMEs was ignored, thus

resulting in inadequately trained Marines sent to FMF units. The problem was confirmed by feedback from operational units, which stated that many of the field wiremen, upon reaching the fleet, were found lacking in basic skills normally expected of their billet and rank (Lewis, 2000). As such, time had to be taken away from other events by the operational units to train these Marines up to the expected level of proficiency.

2. Increased Training Requirements

Another area of concern within this course dealt with the introduction of new communications equipment within the Marine Corps inventory. Many of the new systems being fielded will function as key components of vast communications networks, and will be the responsibility of field wiremen to install, maintain and operate. According to one instructor, "the days of simply running wire and climbing telephone poles are over!" The result of this vast technology explosion is that new equipment is being introduced as complements rather than replacements for existing equipment. A review of the Course Descriptive Data found that the students were currently responsible for gaining proficiency with not less than ten major sets of communications devices, to include accompanying cables, power units and assorted support equipment. The number of systems for which field wiremen are now responsible is therefore increasing rather than decreasing, yet the response of HQMC to this phenomenon is to cut formal training rather than increase it. Even with the introduction of CBT into the classroom, the instructor staff was in consensus that there is still insufficient time currently available to teach the Marines everything they should know to function proficiently in their basic MOS. Additionally, it was explained that due to the reorganization and consolidation of certain MOSs within the communications field (2514 with 2512, for example), the students were now required to learn additional skills that they had previously not been held responsible for at that point in their careers (Rice, 2000). Such requirements have only compounded the problem of insufficient time to teach a myriad of skills and tasks.

3. Automated Electronic Classroom

There were distinctly mixed opinions regarding the application of CBT in the classroom. To support the training effort, the facilities available included an 80-man and 50-man capacity AEC, each providing individual workstations with self-paced,

interactive media work packages. The older, more senior instructors felt the CBT technology had some merit, but that too much emphasis was being placed on this equipment to take the place of traditional student/instructor interaction. In the opinion of these instructors, overall lecture and demonstration time had been significantly reduced, impacting on student comprehension. The younger instructors, however, found that under the present time constraints, the introduction of CBT into the classroom was the only feasible solution to successfully accomplish their jobs. A review of student performance, in terms of test scores and completion rates, provided some measure of how the students were reacting to the new technology. Test averages from three random classes that graduated prior to the activation of the AEC (which occurred in early 1999) totaled approximately 89.39 percent, while those of three random classes that followed totaled 95.14 percent. Granted that this AEC application is still in its infancy and insufficient data currently exist for a more thorough and detailed study, these early indications support claims made by various studies that the use of CBT results in no significant change in student comprehension and learning (Russell, 1999 and Mattoon, 1997). It was recognized, however, that even the junior instructors preferred more lecture and practical application time when possible, finding that similar to the *LABVOLT* example in Company A, overall remediation rates decreased, while the rate of student comprehension and progression increased proportionately. It seems the issue of timesaving though the use of CBT and other automated training technologies was being addressed as previously discussed. Rather than providing more time to devote to other requirements, the saved time was simply being eliminated from the POI, requiring the instructors to do more with less.

4. Advanced Level Training

Advanced skill training was provided in Company B in the Communications Systems Chief Course (CSCC), and the Operations Communications Chief Course (OCCC). The CSCC was conducted three times per year with an average throughput of 120 Marines per year. The OCCC held eight classes per year, consisting of four wire and four radio sub-courses for an average annual throughput of 216 Marines. As part of overall course reductions, the CSCC was shortened from 12 weeks to nine weeks, while the OCCC was cut from 16 weeks to 12 weeks. The CSCC was significantly reorganized after the introduction of the AEC, as part of the curriculum package. Each course

consisted of two subclasses focusing on radio and wire networks respectively. Previously the POI had consisted of only a single class, divided into thirds with an equal amount of time spent on radio, wire and data information systems. The instructors who taught these courses were the most senior instructors within MCCES, having a wealth of both operational and training experience. Their perceptions of the use of CBT within the classroom were generally positive, although they too were in agreement with many of the other school personnel that the time savings realized from the use of automated training technologies were simply being eliminated, rather than used for additional skill development. Their observations were that while the overall quality of the students was excellent, general experience levels were significantly lower due to more rapid promotion practices. This situation thus required more time to instill knowledge that in the past the average student, at that stage of their career, would have taken for granted. General computer skills were also found to be lacking among students in both the CSCC and the OCCC, requiring additional instructor time to familiarize students with the basics of word processing and graphics programs. The particular period of instruction that I observed received basic instruction in the use of Microsoft PowerPoint presentations. This skill was a necessary part of the curriculum requirement, used to illustrate various diagrams of communications networks and plans. Based on discussions with instructor personnel, the general student experience level with such computer programs prior to attending school was moderate, but getting better.

Similar reviews of test scores and overall class averages both before and after the introduction of the AEC, were conducted to gain a better perspective of student performance. A random sampling of three classes prior to the use of the AEC resulted in an overall student average of 92.73 percent, while the cumulative average of three random classes after the use of the AEC was found to be 91.10 percent. The overall failure rate of Marines for these particular courses was so insignificant, both before and after the use of the AEC, that it was not even considered. Once again, it is acknowledged that the while the use of the new training technology is so recent that sufficient data has not yet been compiled for a more detailed analysis, the overall differences appear to be minimal at best. Numerous other studies in the field of civilian industry and academia bear out this “no significant difference” phenomenon (Russell, 1999).

E. THE DL TRAINING NICHE

Based on the increased demands of the advanced level courses, combined with overall reductions in training time, instructors felt that future students required demonstrated proficiency in certain basic skills, prior to arrival at the schoolhouse in order to be successful. Distance Learning technologies were seen as being most useful. By reviewing and refreshing certain core concepts and familiarizing themselves with basic computer processing skills, it was felt that precious time spent on these events could be eliminated. This would allow for more time devoted to advanced learning. As part of this initiative, the staff was currently working on a number of initiatives, to include the use of MCI courses, web-based training and other basic skill preassessment techniques that would allow students to validate as much of the introductory information as possible, while still at their parent units. Thus upon their arrival at the schoolhouse, the experience level of the students would be uniform, allowing more time to be devoted to advanced concepts and techniques. The instructors were quick to point out that in order to be successful, however, certain criteria had to be observed. First, the additional timesavings provided by the use of DL must not be eliminated from the curriculum. Rather, they should be used to provide the additional skills required for the student's rank and experience level. Second, prior to attending the reduced formal portion of the course, the prospective students must be given adequate time, while still at their units, to complete the DL portion of the instruction free from the daily distractions of their regular duties. Failure to observe either of these prescripts would not realize any appreciable savings from the use of DL technologies.

F. SUBJECT MATTER EXPERTS

Another problem area dealt with changes in course curricula based on the infusion of the new technology, both into the classroom and into operational units. Similar to students in entry-level courses, senior Marines are expected to be proficient with the new communications systems continuously being fielded to operational units. The principal concern is from where the training on these new systems for senior Marines is to come. Should they be trained at their units or at the schoolhouse? According to the SAT process and the more recent TEMI, changes in formal school course curricula must be submitted, discussed and approved at a formal annual CCRB. Subject Matter Experts

from the pertinent occupational fields meet and decide which ITSs will be taught at the schoolhouse and which will be disseminated at the local unit level. The problem is that many of the designated SMEs are not SMEs at all. Changes in technology and new equipment occur so rapidly that many of the senior Marines chosen as SMEs are unfamiliar with new technologies and the requirements for proficiency with them. As such, they aggressively push to conduct the majority of the training with this new equipment at the schoolhouse. These same individuals are found to be the ones who then complain when new Marines arrive at their units inadequately trained to operate the equipment. Schoolhouse personnel felt that to properly deal with this problem, SMEs should not be selected solely on the basis of seniority. An individual's work history should be considered as well (Foy, 2000). More importantly, the occurrence of such situations requires a fundamental change in the way the Marine Corps views training. The SAT and the TEMI are good systems, provided the USMC embraces them and doesn't pay them mere lipservice.

G. LEARNING RESOUCE CENTERS

Both MCCES and MCAGCC operate and maintain LRCs for use by students and permanent personnel alike. The AECs located at the schoolhouse were dual hatted as LRCs when not being used for formal classes, while the base maintained a functional LRC comprised of 20 workstations with Internet and Intranet capability. I was specifically interested in looking at usage rates since the introduction of these facilities in mid-1999. Reviewing the logbook for both LRCs, I made the following observations.
The principal categories of usage for the LRCs consisted of education-related topics such as web-based MCI courses, personal e-mail and general Internet applications. Table 4.1 illustrates that from the period of June 29, 1999 when the facilities first opened to December 15, 1999, the average daily use rates in terms of people per day for the MCCES AEC/LRC were as follows:

CATEGORY	Usage Rate (People per Day)
1) Education	00.45
2) Personal e-mail	10.27
3) General Internet	3.00

Table 4.1 MCCES AEC/LRC Average Daily Use Rates from 29 Jun 99 – 15 Dec 99

Inspection of the logbook for the base LRC revealed similar values. This period covers a time span of approximately 62 days, not to include weekends and holidays. After December 15, 1999 personnel were no longer granted personal e-mail access due to increased security measures and bandwidth redesignation. For the period from December 16, 1999 to January 19, 2000, usage rates plummeted to less than one individual per day for both LRCs. The principal use of these facilities made by personnel had apparently been for personal e-mail access. This second finding came as no real surprise for the MCAGCC LRC, based on initial research at the schoolhouse AEC. An equally contributing factor was a series of directives issued by the base Commanding General, who as part of his quality of life initiative, had previously ordered that the LRC be made available to all dependents to contact their spouses while on deployment.

Staff personnel at the schoolhouse were not of the opinion that the AEC would receive much use by students in their off duty hours for DL applications. It was felt that the last thing students would be most likely to do after a full day of formal instruction would be to pursue further learning on their own. An additional consideration was that with reduced classroom time, more homework was being assigned than in the older, longer courses. Most entry-level students are so overwhelmed at this point in their service; they simply have no desire for career-enhancing training unrelated to their MOS. It was recognized that if DL applications had any relevance to entry-level training, it would be for Marines awaiting training. Distance Learning applications could be used as part of the entry-level training requirements separate from the Marine's primary MOS. Competing distractions would be at a minimum. They would be free to concentrate on DL courses. As promising as this initiative sounds, no actions have yet been taken to implement it. MCI currently offers only three electronic courses of instruction, which are as follows (Taylor, 2000):

1) Land Navigation
2) Fundamentals of Diesel Engines
3) Personal Finance

Based on discussion with the LRC facilitator, the electronic tests for these courses do not match the course numbers, leading to confusion for the student and the test administrator. Until MCI solves these problems and converts more of its courses to an electronic format, which it is currently doing, usage rates will remain low.

Perhaps the most disturbing situation I observed during my visit was that T&E Branch is already seeking feedback on the LRC, although insufficient time has elapsed for the system to prove itself. Fully operational for close to nine months, the system has been underutilized for lack of instructional materials. Once this situation is corrected, the potential use of this DL application should increase for the appropriate category of users.

H. CHAPTER SUMMARY

The information gathered at MCCES and MCAGCC thus revealed some interesting inconsistencies between the plan outlined in the USMC's strategic vision for the application of advanced instructional technologies, and what is actually occurring at the schoolhouse as well as in the operational units. Improper use of the SAT and TEMI, combined with flawed expectations of CBT/DL technologies, have resulted in drastic reductions in course lengths, often to the detriment of the quality of instruction. Increased training requirements caused by continuous fielding of new equipment have further complicated already packed training schedules, which as mentioned above, are in the process of being shortened. Problems with the experience level of SMEs, chosen to decide which tasks to teach at the schoolhouse and which to leave with operational units, have brought into question the overall ability and quality of the individual Marine. Finally, a lack of adequate instructional materials has resulted in a gross underuse of the LRCs, by both students and permanent personnel. As serious as these problems are, solutions do exist as evidenced by the recommendations of schoolhouse personnel. The unanswered question is how long will these problems be allowed to manifest themselves before action is taken?

V. ROI METHODOLOGY

A. COST-BENEFIT ANALYSIS PROCESS

CBA encompasses a range of procedures and is not a single technique. Sassone and Schaffer (1978) contend that although CBA incorporates certain general principles, it is difficult to design an all-purpose CBA procedure because of differences in public/government projects. They provide a basic framework for conducting a CBA consisting of initial planning stages followed by data collection, separate cost and benefit analyses, and presentation of results. McMichael (1985) provides a similar framework. While there are some differences in their formulations, the authors would probably agree with Swope (1976) that a CBA process should include the following steps:

- Formulate Assumptions
- Determine Alternatives
- Determine Costs and Benefits
- Compare and Select Alternatives
- Conduct Sensitivity Analysis

Assumptions are usually made regarding what variables will affect the process and the range of values those variables will present. The alternatives will include the new system and one or more other possibilities. Frequently, one of these is an existing system. After the costs and benefits of alternatives have been determined, they are compared and a selection is made. In CBA, the best alternative is the one yielding the greatest net benefit (i.e., the alternative whose benefit value, expressed in monetary terms, less its cost is the greatest) (Simpson, 1995). Orlansky (1989) provides the following concrete example:

> [In] cost-benefit analysis...both the input and output values can be measured in monetary terms. This requires an open market to assess the value...of the output that results from a particular use of resources (i.e., the costs). One example might be a cost-benefit analysis of a particular form of advertising. The costs are those needed to develop and conduct a particular advertising program; the benefits are the profits that may be attributed to the advertising program (p. ix).

Assumptions are required in planning a CBA and these can lead to uncertainty in the outcomes of analyses. If the CBA is locked into a single set of assumptions with the intent of obtaining a definitive result, its outcome may be too fragile to be trustworthy. It is more sensible to vary the assumptions systematically and to provide the results of analyses under different assumptions. This procedure is referred to as sensitivity analysis.

According to Simpson (1995), a CBA does not sufficiently evaluate military projects, however, for there is no market available to establish the monetary value of the output in terms of performance, although inputs can be expressed in monetary terms. He further states that a cost-effectiveness analysis (CEA) is the preferred method used in the DoD to make decisions regarding alternative courses of action where the outcomes affect military performance. Examples may include choosing among a set of the following:

a. Weapons Systems
b. Weapon System Upgrade Programs
c. Training Methods

A definition of CEA analogous to that given earlier for CBA might be an estimation and evaluation of the military value associated with alternatives for achieving defined military goals (Simpson, 1995). CEA is used to help meet military goals (rather than CBA's public/government goals). CEA, like CBA, compares alternatives using a formal process. Criteria decide the outcome for both CEA and CBA, but the criteria differ (i.e. military value for CEA and public benefits for CBA) (Simpson, 1995). *Economic Analysis*, an additional term used in a number of DoD publications, has a meaning synonymous with CEA (Rankin & Swope, 1991).

B. COSTS AND MILITARY VALUE

Simpson (1995) maintains that the costs of alternatives in a CEA are estimated in a manner similar to that of a CBA by using cost models that take into account all of the associated costs of the alternatives through a projected life cycle. He suggests, however, that estimating military value for a CEA is different from estimating public benefits in a CBA. An important difference between CEA and CBA is that the outcome (military value) is not defined in the same terms as cost (Orlansky, 1989; Rankin & Swope, 1991).

The military value of ineffective training methods, for example, is hard to monetize. An instructional program that sends a poorly trained Marine to an operational unit represents an opportunity cost to that unit in terms of lost output. A senior, more experienced Marine must now be detailed from his regular duties to work with the junior Marine to bring the individual up to the desired level of knowledge and skill. The time and effort spent working with the junior Marine is a cost to the unit in terms of the senior Marine's normal output as well as the junior Marine's inefficient output. The benefit of what should be a high-quality training program has now become a cost. Yet how exactly does one associate a value with this cost (i.e., the poor-training program)? According to Boardman, Greenburg, Vining, and Weimer (1996), the intermediate good method can be used to estimate the benefit of a project (the training program) based on its value added to the downstream activity (i.e., a qualified Marine's output in the unit). Investment in the skills and abilities of human beings improves the stock of human capital, and thus make individuals more productive and more valuable to the organization (Boardman, et al., 1996). In terms of a cost analysis, the military value of the intermediate good (the poor training program) has become an opportunity cost in regard to both the junior Marine's lost output, and the senior Marine's normal lost output, which are relevant factors that are difficult to measure. The authors argue that when dealing with such intermediate goods whose linkage to preferences is not clear, a CEA is a suitable alternative to a CBA. Orlansky (1989) said:

> [The cost-benefit] procedure cannot be followed when examining the products of a military weapon or *training program* (emphasis added). There is no open market that can establish the monetary value of increased readiness, better-trained personnel, or better weapons (p. ix).

Simpson (1995) concludes that, ultimately military value is reflected in the degree of combat success. According to his analogy; weapon system A has greater military value than weapon system B if A is more likely to prevail in battle than B. Or, if two training alternatives are being compared, treatment A has greater military value than treatment B if A better equips students to prevail in battle than B. Military value can be assessed empirically only in combat and it is impractical to wait for a war to make an assessment. An alternative to combat is to create a combat-like environment (e.g., to use an instrumented live exercise). In performing CEA, measures of effectiveness (MOE) are

used that ostensibly predict combat success (Simpson, 1995). In the experimental paradigm, Simpson (1995) further defines MOEs as equivalent to dependent variables; the same variables used to assess the impact of an experimental treatment condition.

Like CBA, CEA encompasses a wide range of procedures and is not a single technique. Because of conceptual similarities between CBA and CEA, it is reasonable to extend Sassone and Schaffer's (1978) contention regarding the difficulty of designing an all-purpose CBA procedure to the realm of CEA. Likewise, the basic framework for conducting a CEA parallels that of a CBA, described by Swope (1976), but with a slight change to the third step ("Benefits" becomes "Military Value"):

- Formulate Alternatives
- Determine Alternatives
- Determine Costs and *Military Value*
- Compare and Select Alternatives
- Conduct Sensitivity Analysis

Since cost and military value use different units, selection of alternatives cannot be done on a cost basis alone as with CBA (Simpson, 1995). Orlansky (1989) has described the decision-making logic as illustrated below:

COST	**EFFECTIVENESS**		
	LESS	**SAME**	**MORE**
LESS	UNCERTAIN	ADOPT	ADOPT
SAME	REJECT	UNCERTAIN	ADOPT
MORE	REJECT	REJECT	UNCERTAIN

Table 5.1 Orlansky's Decision Logic Diagram for Evaluating the Relative Effectiveness and Cost of Two Training Methods During CEA (1989)

Orlansky (1989) commented as follows on the interpretation of the diagram.

a. If one alternative is as effective or more effective than another <u>and</u> it costs less, adopt it; it is also the preferred choice if it is more effective and costs the same.
b. If an alternative is less effective <u>and</u> costs the same or more than another to which it has been compared, reject it; this is also the case if it is equally effective but costs more.
c. If any of the following combinations of the cost <u>and</u> effectiveness of an alternative is found, no rational preference can be made;

(1) less effective and less cost
(2) equal effectiveness and equal cost
(3) more effective and more cost

Based on the nature of the data gathered from my observations at MCCES, the characteristics of CEA are particularly relevant here, so a combination of both CBA and CEA will be used to conduct my analysis.

C. BENEFITS AND VALUE ADDED

Measuring the direct benefits or results of instruction is a more complex task than cost identification since some benefits may be difficult to identify. The objective is to attach a quantitative value to each identified benefit, which must be derived from the instructional alternative being examined. There may be other factors that contribute to a given benefit. The analyst must isolate and measure only the effects of training. The American Society for Training and Development's 2000 ASTD State of the Industry report, which outlines trends in over 60 major industries, lists the following as typical benefits to consider when conducting an analysis of DL technology:

- **Reduced training time.** Reductions may be realized in facility, personnel and travel costs, as well as less nonproductive/lost time while the student is in training.

- **Reduced material costs.** Potential cost savings for revision, distribution and maintenance of instructional materials/courseware in electronic format versus printed or "hard copy" materials.

- **Improved on-the-job safety and proficiency:** Translates into fewer accidents and increased productivity.

- **Improved job performance.** Less time to perform/accomplish tasks, increased productivity/efficiency/quality of work, or improved management/command/supervision/decision-making ability, amount of positive versus negative feedback from "clients", changes in employee morale and motivation.

- **Reduced manpower requirements.** Potential manpower savings as a result of increased efficiency or productivity, less supervision required, etc.

- **Reduced equipment requirement.** Simulation training may reduce the need, impact, or expense of allocating actual equipment to train hands-on skills.

- **Higher equipment operational availability.** Fewer operator/maintainer errors, safety incidents/accidents, etc., may result in lower maintenance requirements and equipment/system downtime.

Reduced to its most elemental form, a CBA evaluates costs versus benefits for a particular project. Boardman, et al., (1996), state that the basic decision rule for a single alternative is simple: Add up the present value of benefits (B), add up the present value of costs (C), and see which is larger. If benefits exceed costs, then proceed with the project. If not, stay with the status quo. In short, the analyst should recommend proceeding with the project based on the following formula:

$$NPV = B - C > 0$$

When there is only *one* potential project, proceed with that project if the net present value of benefits (NPV) is positive. When there is more than one alternative to the status quo, the rule is slightly more complicated: *Select the project with the highest NPV* (Boardman, et al., 1996).

As straightforward as this process may seem, however, problems arise in determining precisely what the benefits will be, and more particularly in attaching a monetary figure to those benefits that are identified. Thompson and Strickland (1995), address this issue by incorporating the concept of a *value chain* into the process of cost analysis. According to them, the primary analytical tool of strategic cost analysis is a value chain identifying the separate activities, functions and business processes performed in designing, producing, marketing, delivering and supporting a product or service. The chain starts with raw materials supply and continues on through parts and components production, manufacturing and assembly, wholesale distribution and retailing to the ultimate end user of the product or service (Thompson, et al., 1995). In our case, the raw material is the entry-level Marine attending basic skills training and the senior Marine attending advanced-level training. The ultimate end user is the Marine Corps, or more specifically, the operational units. The key here is to incorporate DL technologies in such a way as to increase the value of the Marine by enhancing his

learning ability and retention skills, while simultaneously reducing the amount of time the Marine is away from the operating forces.

D. ANALYSIS STRATEGY

Continuing on with Simpson's (1995) steps of conducting a CEA, I will now apply them to my observations from MCCES.

1. Formulate Assumptions

My assumptions are as follows:

a. All expenditures on the hardware and software components of *MarineNet* for the active duty force are considered sunk costs, as the money has already been allocated and spent. The system is in place, and may be considered fully operational.

b. I found the RDC at MCCES to be fully manned and operational, and am therefore including course conversion costs as sunk costs.

c. Due to time constraints on the scope of this research, the impact of *MarineNet* and DL technologies on the Reserve component will not be considered.

d. Based on my observations at MCCES, I will only consider DL applications to advanced-skill level training.

e. I will apply the industry standard of an estimated 30 percent reduction in training time due to the application of DL technologies.

f. Based on discussions with schoolhouse personnel, current course reductions did not include calculated savings based on the use of DL technologies.

2. Determine Alternatives

The alternative to incorporating the proposed DL initiatives would obviously be the status quo, since it would make no sense to dismantle the system that is currently in place. The Marine Corps has committed itself to the use of *MarineNet*, and has no choice but to continue down that path. To start from scratch on a completely new program

would result in a net loss on all previous network investment. The remaining question is how DL technologies may be applied to the advances already in place to realize additional benefits in training and education. Although considerable reductions in course lengths have already taken place, these have been instituted without adequate consideration of the use of DL technologies. The focus up to this point has been more on increased classroom efficiency through automation, rather than improvements in preassessment and validation techniques.

3. Determine Costs and Military Value

My initial computations address only cost reductions that have been attributed to CBT, but later consider the additional gains that may be realized by the inclusion of DL applications. I also attempt to focus on a more intangible aspect of these changes, involving the impact upon the military value of the instruction. Table 5.2 represents the current reductions that have already taken place in the reviewed courses. The figures in the Training Input Plan (TIP) column represent original course lengths prior to the implemented reductions that are reflected in the schoolhouse CDDs. The data were compiled from a series of interviews with personnel at T&E Division, HQMC, as well as instructors from MCCES.

Course	Identification	COURSE LENGTH (Days)		30%	Actual
Name	Number	TIP (Old)	MCCES CDD (New)	Reduction (Days)	Reduction (%)
BEC	M092721	93	40	65	57
TTC	M09TA31	112	80	78	29
BFWC	M092471	42	17	29	60
OCCC	M0925A1	118	60	83	49
CSCC	M09CHK1	86	45	60	48

Table 5.2 Current Reductions in Selected Courses at MCCES

Based on the figures in the above table, it can clearly be seen that the current reductions, which are attributable to the inclusion of CBT and improvements in instructional efficiency, have already exceeded the estimated industry standard of 30 percent that is associated with the application of DL technologies. Unfortunately no DL applications

have yet been instituted, leaving one to wonder if further reductions are feasible. Based on discussions with instructors at MCCES, many of these current reductions, directed by HQMC, were excessive, arbitrary, and sacrificed skills critical to the quality of the training. They feel that further reductions could prove imprudent. Examined at face value, one can only wonder how courses of instruction as technical and complex as the ones reviewed above can be cut so drastically and still produce a qualified Marine. This leads back to the concept of estimating military value. Are these current course reductions based solely on cost reduction/avoidance, or is due consideration being given to the finished product (i.e., the skill level of the Marine?) According to personnel at MCCES, such is not the case. Arbitrary reductions combined with failure to follow the provisions of the SAT and TEMI have been the norm rather than the exception, significantly impacting on the military value of the courses.

Table 5.3 represents data collected from both T&E Division, DL Branch, as well as from instructors at MCCES. The model is an exact replica of one used by T&E Division to calculate potential savings based on the application of DL technologies. I was not able to transcribe the data directly, however, as the figures used for the course lengths were in some cases outdated. The course lengths used in my table come directly from the CDDs at MCCES. The number of Man-Days is calculated by multiplying the yearly course input by the course length. Based on the fact that there is no single, proven formula for determining the cost of training a Marine per day, and also in consideration that many military units use outdated/unknown cost factors, I analyzed the data from T&E Division to see what I could find. Interestingly enough, I found that by dividing the total cost of each course after incorporating the 30 percent reduction, by the number of new Man-Days (which also included the 30 percent reduction), I came up with a constant dollar figure of $82.00 per day. This value remained approximate for all 63 MOSs within the data set.

Course	Yearly Input	Current Length (Days)	Annual Man-Days	Man-Day Cost	Annual Course Cost (Man-Days)
BEC	1356	40	54,240	$82	$4,447,680
TCC	188	80	15,040	$82	$1,233,280
BFWC	596	17	10,132	$82	$830,824
OCCC	124	60	7440	$82	$610,080
CSCC	230	45	10,350	$82	$848,700

Table 5.3 Annual Cost Computations of Selected Courses at MCCES

Based on these figures, Table 5.4 illustrates the additional reductions that could be realized if the potential savings associated with DL applications were applied. Potential savings from DL applications will not be applied to personnel in entry-level courses, but instead will be considered for individuals in MAT status.

Course	Current Man-Days	Annual Course Cost (Man-Days)	New Man-Days @ 30% Reduction	New Course Cost @ 30% Reduction	Annual Savings
BEC	54,240	$4,447,680	--------	--------	--------
TTC	15,040	$1,233,280	10,528	$863,296	$369,984
BFWC	10,132	$830,824	--------	--------	--------
OCCC	7440	$610,080	5208	$427,056	$183,024
CSCC	10,350	$848,700	7245	$594,090	$254,610

Table 5.4 Cost Analysis Savings of Selected Courses at MCCES based on use of DL Technology

The calculations are based on a simple reduction of the current number of Man-Days for the appropriate course based on the industry standard of 30 percent. This revised figure is then multiplied by the $82/day cost per student-day value to attain the new course cost, which is then subtracted from the old cost to obtain the annual savings.

4. Compare and Select Alternatives

As seen in the preceding figures, a comparison of the status quo and revised methods of instruction illustrates that savings in overall course costs can be realized through the implementation of DL technologies. The infrastructure already exists and the personnel are in place to convert portions of these courses to a DL format. The key issue

here is to ensure that the proper tasks that easily lend themselves to conversion are the ones that are converted, while the core competencies critical to the schoolhouse environment remain part of the conventional course. To properly accomplish this will entail the participation and agreement of SMEs both from the schoolhouse and operational units. To do otherwise will worsen the current situation in which course reductions have been arbitrary and drastic, with the result of inadequately trained Marines.

5. Conduct Sensitivity Analysis

A properly conducted sensitivity analysis would entail picking the right variables to vary for effect on outcomes. It would involve a review of all tasks and skills associated with each individual course by SMEs. More tasks, while lending themselves to a DL environment would allow for greater reductions in course length, conversely more tasks requiring personal interaction would lengthen or at least maintain course curricula at current levels. Once again, the critical issue here is adequate participation by SMEs from both the schoolhouse and operational units, who follow the precepts of the SAT and TEMI. A further consideration is that the time savings realized from DL technologies are not immediately translated into proportional reductions in classroom time, without first ensuring that all critical tasks and skills are being taught in one form or another. The significant reductions in some of the courses discussed earlier are evidence that insufficient consideration was given to the final ability level of course graduates.

Another variable that could be changed as a part of this analysis would be student throughput, based on a review of the TIP. The TIP is produced in relation to a stated Fiscal Year (FY), and covers one year from execution and four "out-years" for planning. The number of students predicted for each particular course are based on validated training requirements for each fiscal year, necessary to obtain or maintain desired manning levels (TIP User's Guide, 1999). This value is thus an important input to the TIP process that is the basis for manpower and budgeting costs. If this value is overestimated, funds may be over-obligated and not used. If underestimated, special efforts are necessary to fund and obtain unplanned school seats. Personnel responsible for these estimates (i.e., SMEs and Occupational Field Managers) are therefore extremely conscientious and meticulous in their calculations. These values thus remain constant

and are not subject to significant change, as seen in the close approximation between the courses I observed and the corresponding estimations in the TIP.

A final variable that could be changed is the estimated cost per student-day. This value has been found to be quite nebulous, and in many cases totally unrelated to the situation for which it is being used.

E. ROI MODEL

Table 5.5 illustrates the ROI process model used by the ASTD (1998) where sequential steps simplify a potentially complicated method. This ROI model provides a systematic approach to ROI calculations.

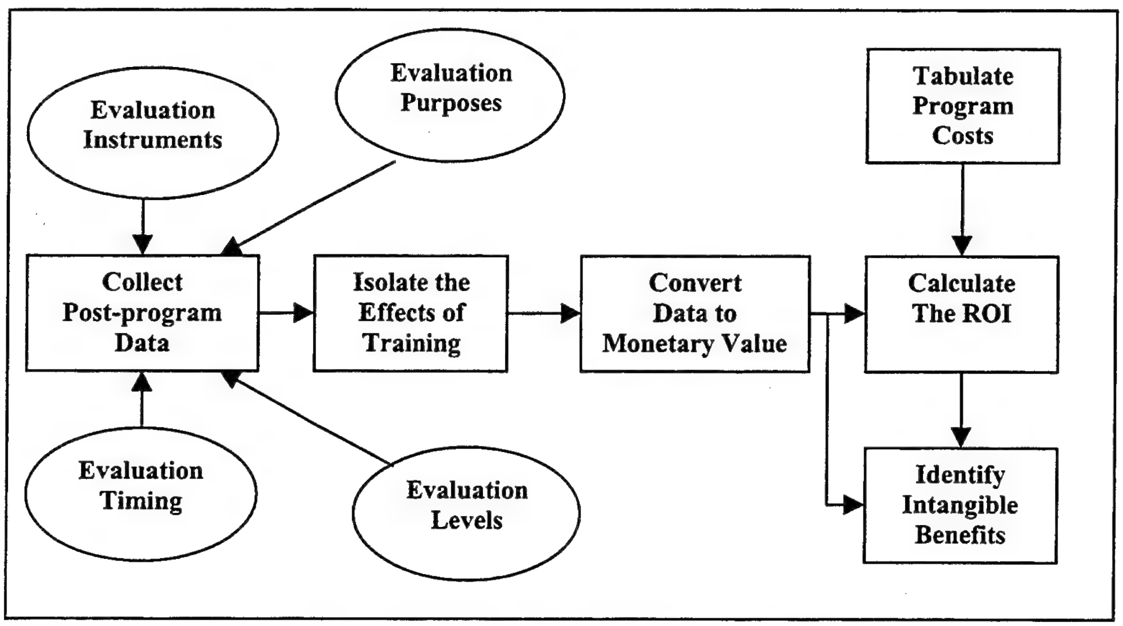

Table 5.5 ROI Process Model from ASTD (1998)

This step-by-step approach keeps the process manageable so that users can tackle one issue at a time. The model also emphasizes that this is a logical process that flows from one step to another. Applying the model from one ROI calculation to another provides consistency, understanding, and credibility (ASTD, 1998).

Data collection is obviously the starting point and most central aspect of the ROI process. As illustrated in Table 5.5, items in the circles are issues that must be addressed

when determining the specific data collection method. This consideration proved particularly challenging for my research as no data supporting the use of DL technology currently exist. As such, those tangible factors discussed in Chapter III were considered first. As indicated in my assumptions, I considered course conversion costs, support costs and resource requirements as sunk costs since the *MarineNet* infrastructure is already in place and operational at MCESS and MCAGCC. The funds allocated for this project have already been spent and are therefore not a consideration in the effects of DL technology applications. Easily quantifiable factors that do impact on a cost analysis include timesavings, reduced travel costs, and increased course efficiency. Based on a study conducted by Bowes (1991) on the average costs of training first-term Marines, Table 5.6 lists values for these factors and combines them as Operation and Maintenance (O&M) costs, student pay, and costs of military instructors.

Course	Direct Costs	Indirect Costs	Student Pay	Cost of Student per Course	Cost of Instructor Time/Course	Total Cost of Course
TTC	$1256	$547	$11516	$13319	$2616	$15,935
CSCC	$631	$368	$6380	$7379	$6670	$14,049
OSCC	$1313	$768	$13,359	$15,440	$6045	$21,485

Table 5.6 Training Costs for Individual Marines from Selected Courses at MCCES, from Bowes (1991)

Based on these total cost values (in 1991 dollars) and the predicted benefits listed in Table 5.4, a benefit cost ratio (BCR) and a figure for ROI can now be calculated for each of the selected courses. Table 5.7 presents these values based on the following formulas:

$$\text{BCR} = \frac{\text{Total Benefits}}{\text{Program Costs}} \qquad \text{ROI} = \frac{\text{Total Benefits} - \text{Program Costs}}{\text{Program Costs}}$$

Course	Total Projected Annual Benefits per Course	Total Annual Course Costs	BCR	ROI (%)
TTC	$369,984	$159,350	2.32	132%
CSCC	$254,610	$112,392	2.27	127%
OSCC	$183,024	$64,455	2.84	184%

Table 5.7 BCR and ROI Calculations on Selected Courses from MCCES Based on DL Technologies

Based on the above computations, for every dollar invested in DL applications for the TTC, $2.32 would be returned. Likewise values of $2.27 and $2.84 could be recognized for every dollar of DL technology invested in the CSCC and OSCC respectively. In

terms of the ROI calculation, for every dollar of DL technology invested, the dollar would be recovered and another $1.32, $1.27, and $1.84 would be produced for the TTC, CSCC, and OSCC, respectively. When extrapolated over several years and applied to other appropriate courses, the benefits/cost savings of DL technologies become even more significant. Unfortunately further research into those specifics is beyond the scope of this paper, but definitely merit further research.

1. Value-added Activities

Another significant, yet somewhat intangible factor that merits further consideration is the impact of DL technology on unit readiness. Unit readiness is currently measured by the Status of Resources and Training Systems (SORTS) report (Marine Corps Manpower System Brief, 1998). The SORTS report has three principal indexes comprised of personnel readiness, equipment readiness, and training readiness. The first two categories are relatively easy to measure in terms of readiness. Either a unit has the authorized numbers of personnel and equipment or it doesn't. Either the assigned equipment works or it doesn't. Accessing the training readiness of the assigned personnel is another matter entirely. Although it can readily be determined whether the assigned personnel have been to the requisite schools for their rank and billet, it is much more difficult to determine the amount of knowledge and skills retained from such training. DL has enormous potential in this area. In terms of unit readiness, you would have more senior personnel in the operational units for more of their obligated time, who now have the same, if not better, opportunities to receive instruction on the most current information put out by the schoolhouse. Moreover, when the time does arrive for those senior personnel to attend a formal school, they can refresh many of their basic skills prior to attending school while still at their parent units. The result of DL applications will be a much more informed and up to date student who can proceed through the formal instruction at a much faster rate, with greater comprehension and retention. Finally, for those personnel unfortunate enough not to be chosen to attend formal school, DL technologies will allow them to stay current on the most recent changes in their respective MOS. From this perspective, DL technologies can be further viewed as a value-added activity that although hard to quantify, improves the overall quality and ability of the learner.

2. Indirect Benefits

Several of the less tangible benefits discussed by Mattoon (1998) equally apply. Based on observations and discussions at MCCES, DL technologies are favorably disposed toward the factors of acceleration, automation, availability, generalizability, longevity (through reinforcement), stability, strategics, and transfer. Although difficult to quantify, indirect benefits such as these warrant consideration when assessing the total value that DL technologies can make to training and education programs. Furthermore, the three-level MOE model used by CNET is equally applicable here and would most definitely provide a favorable return on DL applications. As supported by observations at MCCES, the timesavings MOE has already occurred through the use of the AEC in which substantial reductions in attrition and setbacks were evidenced in the *LABVOLT* example. Follow-on planning is already underway to apply the lessons of this successful experiment to a DL environment that may be exploited by the reserve component (Herring, 2000).

Phillips (1997) states that intangible measures are the benefits or detriments directly linked to the training program, which cannot or should not be converted to monetary values. He maintains that these measures are often monitored after the training program has been conducted and, although not converted to monetary values, are still very important in the evaluation process. A variety of available indirect benefits reflect the success of any training and education program. Although they may not be perceived as valuable as specific monetary measures, they nevertheless are an important part of an overall evaluation. Phillips (1997) further suggests that intangible measures should be identified, explored, examined, and monitored for changes when they are linked to the program. Collectively, he concludes, they add a unique dimension to the overall program results since most, if not all, programs have intangible measures associated with them.

F. CHAPTER SUMMARY

According to Derryberry (1998), many organizations are beginning to require inclusion of a CBA or ROI analysis to justify an expenditure such as what is required for a performance improvement environment or electronic learning system. Simply stated, ROI methods are used to demonstrate that the value of the benefits realized from using such a solution is going to exceed the price of its development and implementation. She

further implies that ROI and technology implementations clearly go hand in hand. Organizations are thus looking for new ways to leverage existing and anticipated technology investments. Consequently, it is important to remember that in applied settings, ROI is particularly valuable as a means to the end of making effective business decisions. In applied settings, research-styled methodological rigor is less the point than developing a well-supported rationale for ensuring that resources are being allocated in economical ways (Derryberry, 1998).

Even so, Derryberry (1998) continues, ROI is not simply evaluation methodology focused solely on financial concerns. Technology decisions are often not just about the financial bottom line. Even if data suggest that a low-end non-technological solution may yield positive results, there may be a variety of organizational reasons that this may not be as attractive to an organizational funder as is a more sophisticated, costly technology solution (Derryberry, 1998). She concludes that while ROI methods provide structure for systematically collecting, organizing and compiling data, the interpretation of those data, and the resulting perception of value those data represent, may be highly subjective.

Phillips (1997) suggests that ROI is a fifth-level addition to Kirkpatrick's four-level evaluation model (1998). He further suggests that instructional designers who have conducted program evaluation using Kirkpatrick's model may notice strong parallels between this expanded view of ROI analysis and each level of Kirkpatrick's evaluation model. Indeed, the design of the front-end ROI analysis and the program evaluation can and should be conceptualized simultaneously so that inputs and outputs to the assessment and evaluation efforts are consistent (Phillips, 1997). In all cases, special care must be given to ensure that changes or values that are being attributed to the performance improvement environment are not, in fact, the result of some other influence (Lachenmaier & Moor, 1997).

This chapter reviewed the CBA process with a focus on the basic steps of a thorough analysis. Discussion centered on concerns associated with estimating military value and the specific application of a CEA to evaluating military versus public sector programs. This was followed by a review of intangible, value-added activities that are difficult to quantify, but nonetheless important to any analysis of training and education programs. A presentation of the analysis strategy outlined the data collected from MCCES and provided a foundation for the ROI model. The ROI process model attempted to demonstrate the potential benefits of incorporating DL technology into the

selected courses based on commonly used BCR and ROI formulas. These calculations were followed by a discussion of some additional significant, yet hard to quantify variables that should be considered as part of the total analysis. Before making a final selection of instructional media, therefore, it is important to determine if the potential benefits accrued by DL or technology insertion outweigh the potential costs, or whether the instruction will be cost-effective and provide an acceptable Return On Investment. The purpose of a cost analysis is to provide the necessary information to facilitate and improve the evaluation and decision-making processes. It is important, therefore, that an accurate and comprehensive analysis of cost/benefit data be accomplished.

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VI. FINDINGS

A. FINDINGS FROM T&E DIVISION, DL BRANCH

1. Funding Support

Establishing a viable DL program for the USMC is a resource-intensive project that has required a significant investment in order to build the necessary infrastructure enabling access for all Marines and Marine Corps civilian personnel. The Marine Corps DL program has already received initial program funding starting in FY99 to establish a representative architecture and complete the pilot initiative (HQMC T&E DL ROADMAP, 1999). Moreover, the DL program is also fully funded for the FY01-05 time frame (HQMC T&E POM-00).

Although the funding issue, which normally represents the biggest hurdle to a program's implementation has been successfully cleared, the Marine Corps DL program is far from fully functional. A number of concerns still remain that must be addressed if the true potential of DL is to be fully recognized by the Marine Corps. To help reduce the overall cost of the program, several on-going initiatives and programs are being leveraged including (HQMC T&E DL ROADMAP, 1999):

- Base Telecommunications Infrastructure (BTI) – This initiative upgrades the telecommunications network infrastructure aboard every base and station between FY97 and FY03. The BTI is already fully funded.

- Reserve Information Network – The R-Net provides telecommunications connectivity to each Marine Corps Reserve site. Total R-Net installation has been completed.

- Marine Corps Satellite Education Network – MCSEN is an existing video conferencing network available aboard major Marine Corps bases and stations. MCSEN is currently devoted to voluntary off-duty education and the academic skills program. MCSEN is fully funded.

- Total Army Distance Learning Program – The TADLP will provide the Marine Corps with additional DL courseware and training opportunities, including access through the Army's Doctrine and Training Digital Library

(ADTDL), the Training Network (TNET), and Satellite Education Network (SEN). The TADLP is funded.

- National Guard Bureau's Distributed Training Technology Program (DTTP) – The DTTP establishes a robust DL infrastructure across all 50 states and is a funded initiative. The Marine Corps and NGB are currently exploring collaboration opportunities for the future.

- Navy DL Programs – CNET is providing assistance with IMI development and connectivity through the CNET's CESN. The Navy DL programs are fully funded.

Taken collectively, each of these initiatives provide a broad foundation of integrated networks and courseware upon which the DL program can interact and expand as needed to reach target audiences. Although not specifically addressed in this study, the cost savings recognized from the exploitation of these systems alone would prove quite substantial since the hardware and supporting infrastructure are already in place. Expanding upon the potential of these established systems rather than starting from scratch simply makes good business sense. Based on my study of the training environment at MCCES, however, I was unable to further access the potential value of incorporating these systems into the USMC DL effort as the DL program is still in the pilot stage and no further work has been done at this time regarding these issues.

2. Funding Assumptions

In addition to the potential savings offered by the use of the above programs, justification for DL program funding was based upon four basic assumptions (HQMC T&E DL ROADMAP, 1999):

1) The TEMI, of which DL is a part, would successfully reduce institutional training time by approximately 30 percent.
2) Known as training buy-back, this training time strategy will reduce traditional resident training tracks thereby reducing the T2P2 account. Marines who finish training sooner can then be sent to the operating forces faster, thus improving operational readiness.
3) As a result of shorter resident training tracks, the frequency of instruction and throughput numbers can be increased accordingly, thus reducing the number of Marines awaiting training.

4) Increased use of DL will reduce TAD expenditures associated with formal training by approximately 30 percent.

B. FINDINGS FROM MCCES

Although by no means totally inclusive, these results represent major issues of concern to the instructors and administrators at MCCES and MCAGCC. Specific findings include:

1. Reductions in observed course lengths, mandated by HQMC and chiefly attributable to CBT, have already taken place at MCCES. These reductions are far in excess of the industry standard of 30 percent normally associated with DL technology. These reductions were viewed by MCCES personnel as excessive, arbitrary, and not in accordance with the provisions of the SAT and TEMI.
2. Although observed course lengths have been systematically reduced and Marines are getting to operational units faster, the quality of those Marines' training has come into serious question by both the schoolhouse and the FMF.
3. Senior instructors tolerated CBT, but felt it was not a suitable replacement for conventional training methods. Their view was that the overall quality of instruction was hampered by reductions in conventional student-instructor interaction methods. Junior instructors favorably endorsed CBT as the best solution to the problem of reduced instructional hours. All personnel interviewed in both groups had been at MCCES prior to the activation of the AEC. Both groups were in agreement that the imposed reductions in the curricula were excessive and sacrificed critical skills necessary to maintain quality instruction.
4. Although no DL applications have been implemented beyond the pilot stage, the complete hardware/software infrastructure (minus content, which will be discussed below) is in place according to plan.
5. The LABVOLT experiment, an automated self-paced instructional system in electronic theory, considerably reduced the overall student recycle/remediation rate from 46 percent to 6 percent. Under the previous traditional lecture method, approximately 80 percent of the students were set back at least once during the course of instruction. Although originally

designed as a stand-alone system, LABVOLT has been found to work most effectively when proceeded by a traditional lecture period. Based on empirical evidence, it was found that no additional training time was needed to incorporate lecture back into the overall curricula, as the students progressed through the self-paced lesson at an increased rate, and with greater comprehension when the instruction began with a short lecture period. While not directly related to the DL program, these impressive results definitely have technology-related implications such as increased comprehension and completion rates.

6. It was the unanimous opinion of all personnel interviewed at MCCES, that with the possible exception of MAT, DL technology had no application to entry-level skill training. This was attributed to the fact that Marines at this level of training are most receptive to and in need of the personal interaction techniques of conventional classroom instruction. Historical evidence suggests that Marines, at this point in their enlistment, are often overwhelmed by the dramatic change in their environment and life style. Attendance at their formal MOS school represents the first real independence new Marines are given following the rigors of basic training and MCT. To expect these young men and women to sacrifice the little free time they are given in pursuit of additional academic challenges is somewhat unrealistic. Furthermore, any type of non-MOS instruction outside of formal training was viewed as a distraction from the Marine's primary duty of excelling in his class. In support of the Marine's transformation process, and in the interest of imbuing the ideals of teamwork and unit cohesion, formal schoolhouse training is therefore considered a must for entry-level training.

7. Company A introduced a maximum training effort to eliminate its MAT problem and realized limited success. Their solution involved increasing the training tempo to 24 hours per day. Problems quickly surfaced that included such issues as equipment failure from overuse, and instructor fatigue. It was discovered that the problem was never really solved, only pushed further down the training pipeline to succeeding phases of training that could not handle the increased throughput. Through a process of trial and error the training tempo was eventually reduced to current levels, which are considered optimal.

8. Although significantly reduced, the MAT problem still existed for Company A. In response, Company A trains their personnel in a MAT status in other non-MOS essential, yet time consuming-functions such as drill and ceremonies, uniform inspections, physical fitness, etc. Although considered an efficient solution to the MAT problem, this approach has not yet been standardized among the other training companies at MCCES.
9. Personnel interviewed at MCCES generally agreed that individuals in a MAT status would be good candidates for DL technology applications. The time would be advantageous for introductory lessons in support of the transformation process such as personal finance, map reading, and other general knowledge courses. There would be no distraction from formal training since it had not yet begun, so the Marines could devote their full attention to the instruction. Once formal MOS related training began, however, it was strongly emphasized that all DL instruction should stop so the Marines could devote their full time and attention toward that effort.
10. Advanced-skill level courses were deemed suitable for DL applications. Distance Learning could aid in refreshing the basic skills of senior Marines prior to formal school attendance. This action would not only allow the Marines to begin the course of instruction at a higher skill level, but would contribute to faster progression and comprehension rates, leading to possible course reduction. Simply stated, preassessment and course compression would be enhanced.
11. Instructors at MCCES felt that CBT and DL technologies should not be used as a blanket excuse to automatically reduce the length of courses. The Marine Corps is continually fielding newer and more complex equipment as compliments to, rather than replacements for, existing equipment. As such, Marines are expected to be intimately familiar with complex networks of technologically sophisticated equipment. Where and when are Marines to be taught how to operate and maintain this increasing inventory of equipment? MCCES personnel suggest that training timesavings realized from CBT and DL technologies should not be automatically eliminated from curricula, but should be maintained for inclusion of additional necessary information.
12. MCCES uses inaccurate costing data. The cost of an individual Marine training day, estimated at $271, had no supporting historical proof. No one at

MCCES could explain where this value came from or under what assumptions it had originally been calculated.

13. Based on my assumptions, I calculated the cost of a Marine training day to be approximately $82.00. Combining this value with previously calculated data on the cost of training first-term Marines, I was able to calculate a BCR and ROI for three observed courses at MCCES. Results were favorable with a positive ROI that averaged approximately 147 percent for the three selected courses, or an average of $1.47 returned for every dollar invested. Elements of a CEA were also included in my analysis, which indicated potential favorable results for DL applications in terms of the military value added. Distance Learning technology has the potential to keep senior Marines in operational units for a longer period of time, while affording them the same opportunities for learning that school trained individuals currently have. Distance Learning applications can thus be viewed as a value added activity that enhances the cost effectiveness of a training program and promotes unit readiness.
14. SMEs chosen for CCRBs are currently chosen on the basis of seniority, and are not necessarily the most experienced individuals in their field. In light of the rapid rate at which modern technology continues to advance, many systems are fielded that the most senior personnel in a unit know little or nothing about. These same individuals, however, are the ones who are chosen, as SMEs, to make decisions concerning which critical skills (regarding these new systems) will be taught at the schoolhouse and which will be handled in the FMF. They obviously push for the schoolhouse to conduct the majority of the instruction. As expected, a dilemma ensues when the responsibility is placed on the schoolhouse to teach an increasing number of these critical skills, while simultaneously the length of the curricula is disproportionately reduced.
15. A review of MOE regarding CBT (i.e., test scores), from three random classes prior to the activation of the AEC and three random classes after, found no significant difference in the performance of the students. These findings applied to both entry-level and advanced-level training courses observed at MCCES.

16. A fully operational VTT facility was located at MCAGCC, but no plans had been designed to exploit its potential as part of a DL program.
17. The LRC, although fully operational at both MCCES and MCAGCC, was significantly underused due to a lack of content. The number of automated courses currently available totaled only three, and failed to generate sufficient interest due to software compatibility problems as well as difficulties with electronic testing procedures. MCI, which has total responsibility for course conversion procedures, has yet to move beyond the initial pilot stage of the program.
18. Insufficient historical data regarding the USMC DL program currently exist to determine the actual contribution DL can make to the Marine Corps. This is due to the fact that the program has not yet proceeded beyond the initial pilot stage, although, as mentioned, the supporting infrastructure is in place and ready for use.

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VII. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

1. DL Program Funding Assumptions

The previously discussed funding assumptions, upon which DL program was justified, represent the logic behind the entire process. I will therefore focus my discussion around these four main points.

a. *Training Time Reduction*

The industry standard of a 30 percent reduction in conventional training time, through the use of DL technology, represents a sound benchmark for a cost analysis, but this figure is by no means always dependable. It was found that all of the courses reviewed at MCCES had already been reduced by more than 30 percent due to the introduction of CBT, as well as improvements in instructional efficiency (Taylor, 2000). Some of these reductions were viewed as capricious and excessive, impacting on the overall quality of the course and the ability/skill level of the graduates. Although my own analysis was based on a similar standard of 30 percent and produced favorable results, the issue remains questionable until DL technology is actually implemented and hard data, in terms of DL course enrollment and completion rates, become available.

In some cases, further reductions in course length of any kind could eliminate crucial skills that cannot be successfully learned other than through face-to-face interaction. Evidence has been presented of deficiencies in the skill levels of new Marines leaving MCCES that must be taught in the operational units. Many of these difficulties have been traced to miscommunication between SMEs at the schoolhouse and in the FMF over critical ITS, and responsibility for teaching them. More importantly, the spirit of the SAT and TEMI, which comprise the foundation of curricula development procedures for the Marine Corps (and were not followed at MCCES), should be more closely adhered to when converting course content to a DL format. This should help ensure that similar mistakes are not repeated with the DL program, and critical skills most suitable for a formal classroom environment are not eliminated in favor of faster completion rates.

Once sufficient content is available for practical use of DL technology, the Marine Corps needs to promote this form of training and education with the utmost enthusiasm. Failure to gain the support of senior personnel, both within the formal school system as well as the FMF, could seriously affect buy-in of the DL program among the rank and file. Linking the use of DL programs with increased advancement opportunities is but a first step toward promoting the acceptance and use of this training process.

In a similar vein, Marines no longer have the luxury to wait until afforded the opportunity to attend a formal school and expect the faculty to provide all the necessary information for proficiency in a relatively limited period of time. Familiarity with elementary computer skills and basic MOS knowledge must already be current prior to attending school. The burdensome operational tempo most Marines face in today's environment certainly does not provide the individual with the time necessary to acquire many of these skills, prior to attending formal training, yet this situation by no means relieves the individual of the responsibility for knowing them. This circumstance is not much different than that faced by civilian counterparts who are continually required to refresh their skills to stay competitive, but are reluctant to take time from their jobs to do so. The individuals who successfully accomplish this formidable task are the ones who can most efficiently manage their time. Distance Learning technologies can significantly affect one's ability to manage time more efficiently for training purposes.

Distance Learning programs can also greatly assist in eliminating the unfamiliarity problem that many senior Marines experience with fielding new equipment in the FMF. Those senior Marines who are expected to be the most knowledgeable in regard to new systems, and yet have the least opportunity to attend formal school, can use DL technology to maintain their MOS skills. A value added consideration here is that DL technology can provide badly needed expertise to senior Marines, who may find themselves chosen as SMEs, and must recommend which skills to teach at school and which to handle in the FMF. Familiarity with DL programs will thus allow SMEs to make better-informed decisions regarding training and education programs.

b. *Training Buy-back*

The issue of training buy-back and its effect on the T2P2 account is also somewhat questionable. The previous CMC specifically directed MCCES and all other

formal Marine Corps schools to reduce the length of courses to get Marines to the operating forces faster and thus improve operational readiness. The first part of this guidance was readily achieved, but the impact on operational readiness remains in doubt for reasons previously discussed. Marines are, in fact, getting to operational units faster, but the quality of their training has come into serious question. Based on my research at MCCES, this problem was again traced to an improper needs assessment by SMEs, who failed to follow the procedures of the SAT and TEMI. Whether DL initiatives will positively affect training buy-back depends upon a thorough analysis by qualified SMEs of those critical skills that must remain in the schoolhouse, and those that may be applied in a DL environment.

Short of total mobilization for war, the Marine Corps continually operates with a Table of Organization (T/O) well below its authorized manning level. Although they may not like it, unit commanders have become accustomed to this situation and in most circumstances manage to meet their obligations with the personnel and equipment that they have. As such, the FMF does not miss the Marines it has not yet received from the training pipeline. Efforts to move entry-level Marines through the training cycle more quickly is a laudable goal, but only if the quality of the training those Marines receive is not sacrificed for the sake of an increased rate of throughput. It does no good to get a Marine to the FMF more quickly if that Marine can't satisfactorily perform his job. Furthermore, unit readiness suffers as training priorities must now be changed to teach the new Marine the skills he should have learned in school. Evidence gathered from MCCES indicates that this has been the case in some instances.

The success of the LABVOLT experiment, although not directly related to DL technology, demonstrates the potential of automation to increase the efficiency of training and education programs. Distance Learning for the Marine Corps is by no means viewed as a panacea for the ailments of traditional classroom instruction, but rather as a complement that will serve to benefit all Marines. Just as the LABVOLT system was found to function most efficiently when combined with limited, traditional lecture periods, DL will provide the greatest benefit when properly combined with current training methods.

In a rush to apply the timesaving benefits of CBT and DL technologies, the Marines Corps needs to consider the warnings of the personnel tasked with working with these technologies. With the increased amount of information that all Marines are responsible for in today's technologically advanced environment, formal schools find

themselves taxed to teach more in less time. Automated technologies can certainly assist in this effort, but the advantages gained through the technology can quickly disappear if there is insufficient time to teach vital information. Compromises will have to be made on both sides of the issue, but the Marine Corps needs to ensure that training and education programs are optimized to meet the needs of the individual Marine and are not solely focused on increased throughput.

c. *Marines Awaiting Training*

Based on initiatives undertaken by instructors at MCCES, the issue of MAT has been addressed with mixed results. Placing Marines in a training hiatus once their course had begun was found to have adverse effects on the retention of knowledge learned from earlier phases of training (Herring, 2000). It was therefore determined that it was in the best interests of the students to place them in a MAT status prior to the start of a course rather than interrupt the training cycle once the POI had begun. The contribution that DL can make to this situation is perhaps the only positive area in regard to entry-level training. It was the unanimous opinion of all personnel interviewed at MCCES that once formal training began for entry-level Marines, DL technology had little application due to the need to maintain academic discipline and enhance knowledge transfer among new Marines.

d. *TAD Reduction*

The assumption that increased use of DL will reduce TAD expenditures associated with formal training by 30 percent is based on industry standard, and will remain as such until hard data becomes available for the Marine Corps to either support or refute this claim. A review of over 33 empirical studies of civilian businesses involved with DL over the past decade has found this figure to be quite reliable (Johnston & Fletcher, 1997). Although easily quantifiable cost figures such as these are most frequently promoted as justification for DL technology, this paper does not suggest that the Marine Corps should continue with its implementation plan simply because the figures and the technology have pushed it there. Barring any insurmountable obstacles to full implementation, however, which this study has not found, the current plan for the DL program should be continued.

2. Summary

Based on my observations at MCCES, significant progress has been achieved in increasing instructional efficiency through the use of automation in the classroom. When properly applied, DL technology will continue this trend with substantial positive returns on the investment. A number of hurdles will have to be cleared before any positive ROI will be realized. For the Marine Corps, DL technology is not applicable to entry-level training, and with the possible exception of personnel in a MAT status, should no longer be considered for this category of training. Distance Learning technology does have enormous potential in the Marine Corps, however, for advanced skill level training and should be implemented to the fullest extent possible as soon as circumstances permit. The potential savings that DL can offer through preassessment training and course compression have been briefly considered in this paper, and definitely merit further study as more data become available. This implementation procedure should not be too hasty, as a thorough needs assessment, in accordance with the SAT and TEMI, is critical to identify the crucial skills that can be taught most effectively in a formal schoolhouse environment.

B. RECOMMENDATIONS

INCREASE MCI INVOLVEMENT. It was observed that the LRCs at MCAGCC were currently underutilized for lack of adequate electronic courses of instruction. The number of courses available totaled only three, and failed to generate sufficient interest due to software compatibility problems as well as difficulties with electronic testing procedures. I am confident that once the MCI, which has sole responsibility for this area, works out these software problems and fields more courses, the full potential of this DL entity will be fully realized. Further research into a cost analysis of the conversion program that MCI is currently using, is definitely warranted.

EXPAND VTT USE. It was also discovered that although MCAGCC has a fully functional VTT site, nothing is currently being done to use this technology for DL applications. The benefit of such technology has been well documented by Cabrera (1999) and rates further study.

FOCUS ON THE RESERVE COMPONENT. Additional research is particularly needed in regard to DL applications and the reserve component of the Marine Corps. Discussions with schoolhouse personnel at MCCES revealed several areas of interest where DL was currently being studied for use in training reserve Marines. Marine Forces Reserve (MARFORRES) has recently invested considerable funding into a prototype of the LABVOLT system for use at selected reserve centers throughout the country (Herring, 2000). Distance Learning applications were found to be particularly applicable to advanced skill level training where reservists could become proficient on the basics of their MOS while at their parent units. Such application would thus permit more efficient use of the two-week active duty period in the summer months, when most reservists usually attended formal schooling (Foy, 2000). A study was conducted by the Marine Corps regarding the potential of DL technology applications for the reserve component (Metzko, et.al., 1996), yet based on my research little has been accomplished since. It is definitely time for a more current study to see where DL can most significantly contribute to the reserve component.

EXPLORE DL APPLICATIONS TO MAT. If DL is to be used at all for entry-level training, the most appropriate time should be for personnel in a MAT status. The application of DL technology and MAT definitely warrants further study for potential training dividends.

ENCOURAGE PERSONAL INITIATIVE. The Marine Corps must continue to emphasize the importance and necessity for the individual Marine to focus on his own educational advancement. As a result of increased training requirements combined with reductions in formal school courses, it is incumbent upon the individual Marine to pursue education and training on his own initiative more than ever before. Distance Learning applications can be of use in this effort.

UTILIZE TIMESAVINGS EFFICIENTLY. Refrain from viewing training technology solely as a curricula-cutting measure. The timesavings realized from the use of CBT and DL technology should not be automatically eliminated from established training schedules. Such technology provides the greatest benefit when used to complement rather than replace conventional training methods.

ELIMINATE INSTITUTIONAL BIAS. To fully realize the potential of DL, the Marine Corps must deal with several challenges. First, the anticipated resistance to change embedded within the institution, although found to be minimal, must be overcome. Distance Learning establishes a new learning environment and considerably

changes established training and education paradigms. Such changes will naturally meet resistance due to lack of experience with curriculum development procedures developing effective DL solutions, unfamiliarity with the technology, and the erroneous perception that DL will eliminate jobs or diminish resident instruction. Lack of personal experience appears to be the key reservation among detractors of DL programs. The Marine Corps must aggressively endorse the value and use of DL technology.

PROMOTE PERSONAL INCENTIVES. To promote effective buy-in of DL technology among Marines, a system of incentives for DL programs that is tied to promotion or advancement opportunities must be established. Such incentives will most likely provide the catalyst for rapid expansion of current DL initiatives.

PROVIDE GUIDANCE AND MENTORSHIP. Providing effective mentoring and maintaining cohesion in a distributed training environment will prove challenging. The shift to student-centered learning must be balanced with a team training approach that is supported and supervised by senior leaders. This shift in learning methods will by no means occur overnight, but will require several years to implement. Furthermore, not every Marine will learn at the same pace using this approach. Some Marines will require a more structured learning environment along with increased personal interaction to facilitate learning. Any training and education solution that is developed must be flexible enough to accommodate alternate learning methods and schedules. The key ingredient to this concept will be establishing an environment at the unit level that is conducive to learning and providing the proper leadership to ensure that DL programs are successfully completed.

FOLLOW THE SAT AND TEMI. Evidence gathered from MCCES reveals that many of the problems encountered when applying automated training technology resulted from a failure of experienced SMEs to properly follow established procedures. These publications clearly outline the proper method for developing, changing, and updating curricula. Following these procedures when converting existing course materials to a DL format, or when developing new curricula, will avoid many of the problems encountered in this study. Furthermore, as indicated in these directives, SMEs should be chosen based on experience levels, rather seniority alone. A more careful screening of SMEs will avoid many of the pitfalls associated with an improper needs assessment, when reviewing curricula for DL conversion.

FURNISH ACCESS TIME. Issues regarding Internet access aboard Marine Corps bases and stations must also be addressed and resolved prior to realizing the full

benefit of DL. A recent study by the Army Research Institute (ARI, 1998) revealed that over 70 percent of the officers interviewed had regular Internet access, while only 30 percent of the enlisted soldiers interviewed had similar Internet access. Accordingly, the Army has identified lack of Internet access for soldiers as a critical barrier to success in their DL program. Although the Marine Corps has not yet conducted a similar study, it seems logical that similar percentages could be applied to the Marine Corps personnel. In order for DL to fully succeed therefore, Marines must have significantly greater access to the Marine Corps network and the Internet.

High operational tempo also makes finding additional time to train and educate very difficult. Finding time for Marines and civilian personnel to learn represents perhaps the greatest challenge to leaders, trainers and educators in the information age. DL programs cannot be relegated to off-duty hours. If the Marine Corps is to realize the full potential of new instructional delivery methods, deliberate steps must be taken to schedule training and education events into normal duty hours.

<u>REVIEW COHORT QUALITY & DL</u>. A final consideration of my study regards the quality of the Marines attending MCCES. The quality of the training cohorts attending MCCES is among the highest in the Marine Corps, as these types of courses require higher Armed Forces Qualification Test (AFQT) scores to successfully meet the demands of the billets (i.e., to maintain and repair complex electronic and technical equipment). As such, it would be beneficial to see if a relationship exists between the success rate that Marines experience with DL technology and their level of intelligence. It would be interesting to examine the success rates with CBT and DL applications at other formal schools within the Marine Corps. Also, with increasing numbers of non-high school graduates entering the Marine Corps, it will be equally interesting to see how well prepared these Marines of the future will be for an automated training environment, particularly one that emphasizes self study through DL technology. Once sufficient data from DL applications become available, further research should be conducted in this intriguing area of training and education.

<u>BE PATIENT</u>. Due to the fact that the Marine Corps has yet to actively implement any DL programs beyond the initial pilot stage, there is a lack of sufficient data to do a more thorough analysis. Although the early results of automation in the classroom have been positive regarding ROI and the contribution that DL technology can make appears promising, it is clearly much too early to reach any final conclusions. The USMC's DL roadmap for the future must be given sufficient time to be fully

implemented and allowed to reach fruition before its ultimate utility can be properly judged. The issue should therefore be revisited in about three to five years.

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APPENDIX A. ROI DATA FOR USMC MILITARY OCCUPATIONAL SPECIALTIES COMPILED AT HQMC, T&E DIVISION, DL BRANCH, 1999

MOS	CID	COURSE NAME	Input	LEN	CURR RED	MAN-DAYS	NEW Man-Days	MAN-YR	MAN-Yr Svngs.	cost at 30 % RED	Ann. Svngs.	MOS
Completed												
0311	**M030314**	RIFLEMAN	2445	59	34	144,255	83,130	228	167	$6,832,603	$5,023,973	**0311**
0311	**M100312**	RIFLEMAN	2445	59	34	144,255	83,130	228	167	$6,832,603	$5,023,973	**0311**
0331	**M100332**	MACHINE GUNNER	531	59	49	31,329	26,019	71	15	$2,138,548	$436,438	**0331**
0331	**M030334**	MACHINE GUNNER	500	59	49	29,500	24,500	67	14	$2,013,699	$410,959	**0331**
0341	**M100342**	MORTARMAN	553	59	49	32,627	27,097	74	15	$2,227,151	$454,521	**0341**
0341	**M030344**	MORTARMAN	510	59	49	30,090	24,990	68	14	$2,053,973	$419,178	**0341**
0351	**M030354**	ASSAULTMAN	580	59	49	34,220	28,420	78	16	$2,335,890	$476,712	**0351**
0351	**M100352**	ASSAULTMAN	430	59	49	25,370	21,070	58	12	$1,731,781	$353,425	**0351**
0352	**M10T2B2**	ANTI-TANK GUIDED MISSILEMAN	287	59	49	16,933	14,063	39	8	$1,155,863	$235,890	**0352**
0352	**M03T2B4**	ANTI-TANK GUIDED MISSILEMAN	260	59	49	15,340	12,740	35	7	$1,047,123	$213,699	**0352**
0313	**M10H2F2**	LIGHT ARMORED VEHICLE CREWMAN	300	59	71	17,700	21,300	58	(10)	$1,750,685	($295,890)	**0313**
Planned												
59/28	M092721	BASIC ELECTRONICS <BEC>	1710	59	38	100,890	64,980	178	98	$5,340,822	$2,951,507	**59/28**
2841	M0927M1	GROUND RADIO REPAIR <GRRC>	350	109	76	38,150	26,705	73	31	$2,194,932	$940,685	**2841**
2841	M0927V1	RADIO FUNDAMENTALS <RFC>	491	42	29	20,622	14,435	40	17	$1,186,471	$508,488	**2841**
2531	M0925U1	FIELD RADIO OPERATOR <FROC>	2000	59	41	118,000	82,600	226	97	$6,789,041	$2,909,589	**2531**
2512	M092471	FIELD WIREMAN COURSE	568	42	29	23,856	16,699	46	20	$1,372,537	$588,230	**2512**
4066	M02D3J1	ENTRY LEVEL SMALL COMPUTER SYSTEMS SPECIALIST	320	50	35	16,000	11,200	31	13	$920,548	$394,521	**4066**
1812	A13TBM1	M1A1 ARMOR CREWMAN (USMC)	243	90	63	17,000	11,900	33	14	$978,082	$419,178	**1812**
3521	M0335H7	AUTOMOTIVE ORGANIZATIONAL MAINTENANCE	1080	87	61	93,960	65,772	180	77	$5,405,918	$2,316,822	**3521**
121	M0301C8	PERSONNEL CLERK	525	50	35	13,573	9,501	26	11	$780,912	$334,677	**121**
131	M0301S8	UNIT DIARY CLERK	510	39	27	19,890	13,923	38	16	$1,144,356	$490,438	**131**
151	M0301T8	ADMINISTRATIVE CLERK	1230	63	44	77,490	54,243	149	64	$4,458,329	$1,910,712	**151**
5811	A10RF31	MILITARY POLICE (USMC)	1064	63	44	67,032	46,922	129	55	$3,856,636	$1,652,844	**5811**
3381	A1433L1	FOOD SERVICE SPECIALIST	1120	58	41	64,960	45,472	125	53	$3,737,425	$1,601,753	**3381**
6412	N23A952	AVIONICS TECHNICIAN I LEVEL CLASS A1	589	105	74	61,845	43,292	119	51	$3,558,205	$1,524,945	**6412**

3043	M0330V1	ENLISTED SUPPLY BASIC	1020	49	34	49,980	34,986	96	41	$2,875,562	$1,232,384	3043
6423	N23A972	AVIATION ELECTRICIANS MATE STRAND CLASS A1	500	91	64	45,500	31,850	87	37	$2,617,808	$1,121,918	6423
1371	M031302	BASIC COMBAT ENGINEER	780	51	36	39,780	27,846	76	33	$2,288,712	$980,877	1371
1833	M10AHY3	ASSAULT AMPHIBIAN CREWMAN	542	64	45	34,688	24,282	67	29	$1,995,748	$855,321	1833
6073	N236482	AVIATION SUPPORT EQUIPMENT TECHNICIAN CLASS A1	275	114	80	31,350	21,945	60	26	$1,803,699	$773,014	6073
1345	A1613F1	ENGINEER EQUIPMENT OPERATOR (USMC)	454	66	46	29,964	20,975	57	25	$1,723,956	$738,838	1345
1391	A141351	PETROLEUM SUPPLY SPECIALIST	450	65	46	29,250	20,475	56	24	$1,682,877	$721,233	1391
6541	M04G3M4	AVIATION ORDN. TECH., INTERMED. MAINT.	270	99	69	26,730	18,711	51	22	$1,537,890	$659,096	6541
6672	N3330B1	MARINE AVIATION SUPPLY	426	59	41	25,134	17,594	48	21	$1,446,066	$619,742	6672
28/59	M09TA31	TECHNICIAN THEORY <TTC>	215	112	78	24,080	16,856	46	20	$1,385,425	$593,753	28/59
844	A200811	FIELD ARTILLERY FIRE CONTROLMAN (USMC)	238	49	34	22,855	15,999	44	19	$1,314,945	$563,548	844
1341	A1613B1	ENGINEER EQUIPMENT REPAIRER	404	56	39	22,624	15,837	43	19	$1,301,655	$557,852	1341
6056	N23WSG2	AVIATN STRUC. MECH., (STRUCTURES) CMN CORE ORG./ INT.LVL	610	37	26	22,570	15,799	43	19	$1,298,548	$556,521	6056
6541	N23G3U2	AVIATION ORDNANCEMAN COMMON CORE CLASS A1	751	30	21	22,530	15,771	43	19	$1,296,247	$555,534	6541
2111	A0121M1	SMALL ARMS REPAIRER (USMC)	351	64	45	22,464	15,725	43	18	$1,292,449	$553,907	2111
4421	M0358X8	LEGAL SERVICES SPECIALIST	250	55	39	21,350	14,945	41	18	$1,228,356	$526,438	4421
2500	M09CHK1	COMMUNICATION SYSTEMS CHIEF COURSE	240	86	60	20,640	14,448	40	17	$1,187,507	$508,932	2500
60/61/73	N2373C2	NAVAL AIRCREWMAN CANDIDATE SCHOOL	500	33	23	20,335	14,235	39	17	$1,169,959	$501,411	60/61/73
2532	M09CGM1	MULTI-CHANNEL EQUIPMENT OPERATOR	300	56	39	20,300	14,210	39	17	$1,167,945	$500,548	2532
231	N460JA2	MAGTF INTELLIGENCE SPECIALIST ENTRY	210	84	59	19,250	13,475	37	16	$1,107,534	$474,658	231
2141	M1018Y3	ASSAULT AMPHIBIAN REPAIRMAN BASIC	192	98	69	18,816	13,171	36	15	$1,082,564	$463,956	2141
63/64	N23A942	AVIONICS COMMON CORE CLASS A1	388	49	34	17,836	12,485	34	15	$1,026,181	$439,792	63/64

7051	F0764T2	FIRE PROTECTION APPRENTICE (MARINES)	268	66	46	17,688	12,382	34	15	$1,017,666	$436,142	**7051**
3533	A1635Z1	LOGISTICS VEHICLE SYSTEM OPERATOR	550	32	22	17,600	12,320	34	14	$1,012,603	$433,973	**3533**
1171	M031102	BASIC HYGIENE EQUIPMENT OPERATOR	243	72	50	17,496	12,247	34	14	$1,006,619	$431,408	**1171**
2542	M092541	COMMUNICATIONS CENTER OPERATOR (CCOC)	252	66	46	16,632	11,642	32	14	$956,910	$410,104	**2542**
6324	N23A962	AVIONICS TECHNICIAN O LEVEL CLASS A1	662	35	25	15,200	10,640	29	12	$874,521	$374,795	**6324**
811	A200821	CANNON CREWMAN (USMC)	664	35	25	15,050	10,535	29	12	$865,890	$371,096	**811**
2311	A2123C1	AMMUNITION SPECIALIST	375	38	27	14,250	9,975	27	12	$819,863	$351,370	**2311**
1142	M03UAA2	ELECTRICAL EQUIPMENT REPAIRMAN	270	108	76	13,500	9,450	26	11	$776,712	$332,877	**1142**
5711	A10T3B2	NUCLEAR BIOLOGICAL CHEMICAL DEFENSE (USMC)	200	66	46	13,200	9,240	25	11	$759,452	$325,479	**5711**
3051	M03SCM1	BASIC WAREHOUSEMAN MOJT	360	36	25	12,960	9,072	25	11	$745,644	$319,562	**3051**
3051	M07SCM1	BASIC WAREHOUSEMAN MOJT	360	36	25	12,960	9,072	25	11	$745,644	$319,562	**3051**
1141	M0311B2	BASIC ELECTRICIAN	240	50	35	12,000	8,400	23	10	$690,411	$295,890	**1141**
100	M03AAD8	ADVANCED PERSONNEL ADMINISTRATION	280	42	29	11,760	8,232	23	10	$676,603	$289,973	**100**
3112	A08TNA1	TRAFFIC MANAGEMENT COORDINATOR	194	59	41	11,446	8,012	22	9	$658,537	$282,230	**3112**
7041	N3370C1	MARINE AVIATION OPERATIONS SPECIALIST	190	58	41	11,020	7,714	21	9	$634,027	$271,726	**7041**
481	M0313I2	BASIC LANDING SUPPORT SPECIALIST	320	34	24	10,880	7,616	21	9	$625,973	$268,274	**481**
3051	M17SCM1	BASIC WAREHOUSEMAN MOJT	299	36	25	10,764	7,535	21	9	$619,299	$265,414	**3051**
6046	N336441	AVIATION MAINTENANCE ADMINISTRATIONMAN CLASS A1	250	42	29	10,500	7,350	20	9	$604,110	$258,904	**6046**
63/64	N23A932	AVIONICS COMMON CORE CLASS A1	1500	49	34	10,045	7,032	19	8	$577,932	$247,685	**63/64**
5952	N23E2X2	AVIONICS COMMON CORE CLASS A1	200	49	34	9,800	6,860	19	8	$563,836	$241,644	**5952**
3531	A1635X1	MOTOR TRANSPORT OPERATOR (USMC)	2596	42	29	9,100	6,370	17	7	$523,562	$224,384	**3531**
861	A200H61	ARTILLERY SCOUT OBSERVER (USMC)	196	31	22	6,076	4,253	12	5	$349,578	$149,819	**861**
						2,105,140	**1,460,371**	**4,001**	**1,766**	**$120,030,468**	**$52,994,737**	

APPENDIX B. ABBREVIATIONS AND ACRONYMS

ACSDE	American Center for the Study of Distance Education
ADTDL	Army Doctrine and Training Digital Library
AEC	Automated Electronic Classroom
AFIT	Air Force Institute of Technology
AFQT	Armed Forces Qualification Test
ALC	Area Learning Center
AOB	Average on Board
BFWC	Basic Field Wireman's Course
BTI	Base Telecommunications Infrastructure
BSNCOC	Battle Staff Noncommissioned Officer's Course
CBA	Cost Benefit Analysis
CBT	Computer Based Training
CCRB	Course Curriculum Review Board
CDD	Course Descriptive Data
CD-ROM	CD-Read-Only Memory
CEA	Cost Effectiveness Analysis
CESN	CNET Electronic Schoolhouse Network
CMC	Computer-mediated Communications
CNA	Center for Naval Analyses
CNET	Chief of Naval Education and Training
CNO	Chief of Naval Operations
CSCC	Communications Systems Chief Course
DII	Defense Information Infrastructure
DISN	Defense Information Systems Network
DL	Distance Learning
DLC	Distance Learning Center
DoD	Department of Defense
DTTP	Distributed Training Technology Program
EO	Executive Order
EPSS	Electronic Performance Support Systems
ET	Embedded Training
FLC	Functional Learning Center
FMF	Fleet Marine Force
GFE	Government Furnished Equipment
GFL	General Facilitative Links
IDA	Institute for Defense Analyses
IDEA	Institute for Defense Education and Analyses
IMI	Interactive Multimedia Instruction
IT	Information Technology
ITS	Individual Training Standards

ISD	Instructional Systems Development
LCCE	Life Cycle Cost Estimate
MARFORRES	Marine Forces Reserve
MAT	Marines Awaiting Training
MCAGCC	Marine Corps Air Ground Combat Center
MCCES	Marine Corps Communications and Electronics School
MCI	Marine Corps Institute
MCSC	Marine Corps System Command
MCSEN	Marine Corps Satellite Education Network
MCT	Marine Combat Training
MCTFS	Marine Corps Total Force System
MOE	Measure of Effectiveness
MOS	Military Occupational Specialty
N/MCI	Navy/Marine Corps Intranet
NPV	Net Present Value
OCCC	Operations Communications Chief Course
ODUSD(R)	Office of the Deputy under Secretary of Defense (Readiness)
OUSDP&R	Office of the Under Secretary of Defense for Personnel and Readiness
PCS	Permanent Change of Station
POI	Program of Instruction
POM	Program Objective Memorandum
R-NET	Reserve Information Network
ROI	Return on Investment
PME	Professional Military Education
R&D	Research and Development
RDC	Regional Development Center
SAT	Systems Approach to Training
SEN	Satellite Education Network
SFL	Specific Facilitative Links
SME	Subject-Matter Expert
SORTS	Status of Resources and Training Systems
T2P2	Transients, Trainees, Patients, and Prisoners
T&E	Training and Education
TAD	Temporary Additional Duty
TADLP	Total Army Distance Learning Plan
TCP/IP	Transmission Control Protocol/Internet Protocol
TDY	Temporary Duty
TEMI	Training and Modernization Initiative
TEPOP	Training and Education Point of Presence
TIP	Training Input Plan
TNET	Training Network

TRADOC	Training and Doctrine Command
TTC	Technician Theory Course
VR	Virtual Reality
VTC	Video Teleconferencing
VTT	Video Teletraining

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